



FRIDAY, JULY 1.

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Contributions.

Steel or Iron Staybolts.

NEW YORK, June 27, 1891.

TO THE EDITOR OF THE RAILROAD GAZETTE:

In your issue of the 17th inst. I notice an interesting communication on the use of staybolts in locomotives, and from the general tenor, judge that iron staybolts are preferred to those of steel.

I beg to ask through your columns if this is generally the case, and whether the best soft steel has been used, and filleted threads provided?

If steel has been given an equally favorable trial with wrought iron, and has proved itself deficient, it would indicate an important difference in the characteristics of the two materials, which should be recognized in all structural work under similar conditions.

HENRY B. SEAMAN.

Acid or Basic Steels for Fireboxes.

Pittsburgh Testing Laboratory, Pittsburgh, Pa., June 27, 1892.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I write to confirm from my experience the communication of Mr. Geo. W. Goetz, regarding the use of basic open hearth steel for boiler and firebox purposes as compared with acid open-hearth steel (see the *Railroad Gazette*, June 24). I think, however, that Mr. Goetz will agree with the provisions given below, from his, probably larger experience in the manufacture of basic open-hearth steel than any one else in this country, and probably but few abroad have had better opportunities than he to judge of the relative products of acid and basic steels.

Mr. Goetz says: "There is no reason why the basic process should not make as good steel as acid, but there is every reason why it should make better, and if chemical and physical tests show anything, it is better in every respect." I would modify this statement by saying: "There is no reason why the basic process should not make as good *soft* steel as acid," etc. The basic process reducing the phosphorus to a minimum provides not only a soft steel, but one naturally low in tensile strength, and for firebox steel, especially, provision should be made for this in the demands of the specifications for tensile strength. With acid open-hearth steel of .12 per cent. carbon with, say .03 per cent. phosphorus, and manganese, say .35 per cent., the tensile strength of fire box steel has been from 55,000 to 65,000 lbs. per square inch. With a similar basic open-hearth steel with phosphorus below .01%, the tensile strength will run from 50,000 to at most 58,000 lbs. per square inch. If the specification demands the higher tensile strength of 55,000 to 65,000 lbs. per square inch, it will become necessary for the steel manufacturers to add an increased amount of carbon to the steel, which makes it much more liable to the effects of hardening. We have lately had under our inspection basic steel with carbon up to .27% in order to answer this higher tensile strength requirement. In my judgment, this was not as good a quality of steel as the lower tensile strength and lower carbon steel would have been, for firebox or boiler steel.

This point, it seems to the writer, should be well considered by those drawing up specifications which will entail the use of basic open-hearth steel. So far as our experience has gone the lower tensile strength material has not meant, as would be likely to be with acid steel of this low tensile strength, extremely low carbon and consequent openness of structure, due to contained blow-

holes in the ingots which are liable to incur with very low carbon steel.

With the provision that specifications for firebox steel do not demand over at most 60,000 lbs. per square inch tensile strength, I would heartily agree with the statements of Mr. Goetz in the matter of indorsing basic open-hearth steel for firebox and boiler plate purposes.

For structural purposes the same remark applies. Basic steel is all right, allowing the tensile strength to increase to at most 68,000 lbs. per square inch. In the writer's judgment, however, a higher unit strain can be placed more safely upon the softer basic open-hearth steel of 55,000 to 64,000 lbs. per square inch than upon steel of higher tensile strength. ALFRED E. HUNT.

The White Button Movement.

TO THE EDITOR OF THE RAILROAD GAZETTE:

FORT DODGE, Ia., June 25, 1892.

I want to say a word to the railroad officials, especially those of the operating departments. The subject matter of what I wish to say is not exactly what would be expected in a technical journal like yours; still, it is to my mind important, and not knowing of any other medium through which I can reach so many, I come to you, hoping you will spare me the room.

My relations with the railroad employes of this nation are very pleasant and close, and I wish to use this relation to the best good of these men. I find in my addresses to them in many public meetings, that no topic elicits more hearty applause and interest than that of total abstinence from all intoxicants, by all classes of men engaged in train service.

These different organizations and brotherhoods have done a wonderful work among themselves in this matter of temperance, and there is a growing feeling among them that the only true and safe ground to stand upon is that of total abstinence at all times, off as well as on duty. The fact that so *interdependent* is every one upon the faithfulness of every other one is coming to be better appreciated. Men should always be clear-headed and steady-handed, and they realize that no man can be this if he tampers with drink. To encourage this sentiment, and crystallize it, I have started what is called the "white button movement." Ten thousand white buttons, with R. R. T. A. on the white background, meaning Railroad Temperance Association, have been made and distributed, and already these are being worn by engineers and other trainmen in every State and Territory of the Union. So great is the demand that I have ordered 50,000 more.

Now comes what I want to say to operating officials. You all know the power of example. You want every man that runs your trains to be a temperate man. When one of these men comes into your office or sees you on the train with a white button in the lapel of your coat, he at once says to himself: "This official expects me to be a temperance man. He will have more confidence in me if he sees I wear a white button in good faith." A new man applying for a position seeing a white button worn by the master of motive power or trainmaster will say to himself: "There is no show for me here unless I am a white button man." In these days of so many accidents there is a suspicion that the saloon has something to do with some of them, and there is a general feeling toward a higher standard of temperance among all railroad men. This white button movement is the outgrowth of that sentiment. L. S. COFFIN.

The Railroad Telegraph Superintendent's Association.

The eleventh annual meeting of this association was held at Denver, Col., June 15 and 16, in accordance with the action of the meeting last year, at which General Manager E. St. John tendered the courtesies of the Rock Island Route to the Association. All the arrangements had been fully perfected by A. R. Swift, Superintendent of Telegraph, and the main party assembled at Chicago, from whence they started for Denver June 12. They arrived at their destination June 14 and the first session of the meeting was called to order at 10:30 A. M. June 15 by President C. S. Jones. The following new members were elected: G. R. Stanton, F. H. Benjamin, C. L. Rhodes, L. S. Wells, J. S. Evans, G. B. McCoy, W. W. Ryder, E. E. Rittenhouse, Mr. Matherson, and J. H. Crawford. The following honorary members were elected: Messrs. J. J. Dickey, D. J. Higgins, R. W. Pope, T. R. Taltavall, T. D. Lockwood, T. A. Edison, and Prof. W. T. Gardner. The following officers were elected to serve next year: President, L. H. Korty, Union Pacific; Vice President, U. J. Fry, Chicago, Milwaukee & St. Paul; Secretary and Treasurer, P. W. Drew, Wisconsin Central. Milwaukee was chosen as the place for the next annual meeting, June 20, 1893.

Mr. S. S. Bogart read a paper on Batteries, in which he called attention to Mr. Lang's paper last year, where one of the chief difficulties in operating electric railroad signals was stated to be the sulphating of the zincs. The speaker had been using type "G" of the Edison-Lalande battery, having an internal resistance of about $\frac{1}{10}$ ohm, and whose constancy is maintained from start to finish. He did not believe that it would sulphate, and he was using it for block signals in preference to all others. Four cells are used in series, closed circuit with a resistance of 10 ohms interposed. There is tapped from it a sounder, alarm bell and annunciator, the last two on the same cell. An-

other important feature, especially for signal work, is the low temperature which the solution will stand without solidifying. It has been tested to 50 deg. F. below zero without congealing, while the ordinary cell will solidify at a temperature a few degrees below the freezing point of water. He believed that the old forms of blue vitriol battery should be discarded, now that it is possible to obtain one which is more satisfactory.

At the afternoon session a paper on Insulation, contributed by Mr. Thomas A. Edison, was read by Mr. M. B. Leonard. This is believed to be the first paper ever prepared for an electrical association by Mr. Edison. It was listened to with marked attention. It was brimful of facts and every line evidenced the fact that Mr. Edison's investigations in this as in other branches of science have extended into every corner of the field.

Mr. T. D. Lockwood gave a blackboard talk on the galvanometer and its uses. He said it was still a prevalent notion that the galvanometer is a mysterious instrument, and that to work it successfully required a knowledge of the higher mathematics. This was an error, as a knowledge of common arithmetic only was necessary. The galvanometer properly handled was an efficient substitute for both the ammeter and voltmeter. It was, however, best adapted for the measurement of resistance. The most common and useful form of the instrument was the tangent galvanometer, which Mr. Lockwood then described. He pointed out the necessity of testing wires for resistance, as bad joints and connections could be readily detected by this practice; with the aid of the galvanometer it was also possible to determine the proper amount of battery to be used on a line.

A paper on electricity and its relations to transportation was read by Mr. Charles Selden, of the Baltimore & Ohio. The first part of Mr. Selden's paper was devoted to a historical sketch of the progress of the telegraph, beginning on the Baltimore & Ohio in 1843; the telephone, beginning with the invention of Reis in 1861 and the electric motor, beginning in 1835. Mr. Selden then discussed the probabilities of electric motors taking the place of steam locomotives on ordinary railroads, taking an optimistic view, as do most electrical men. Speaking of the use of electric motors in the tunnel of the Baltimore Belt railroad in Baltimore, which is now being prepared for, Mr. Selden said:

With singular appropriateness, and perchance, strange coincidence, it falls to the lot of the same corporation that first bore the imprint of electricity in its relation to transportation, to be the one upon which the great task is now thrown of demonstrating the power of the electric motor as a tonnage mover. In the Baltimore & Ohio tunnel, at Baltimore, arrangements are now making for a demonstration which cannot fail to be of great moment to the transportation world. The question of expediency and comfort, rather than economy, prompted the trial of a motor, and so sanguine is such a corporation as the Thomson-Houston Co., that they have contracted to equip the tunnel in such manner that the electric motor shall be capable of a speed with passenger trains of 30 miles an hour, and freight trains at 15 miles an hour. It is expected that three motors will be more than sufficient to move 300 trains a day, each freight train's maximum weight to be 1,200 tons. The motors will encounter grades varying from 45 to 90 ft. per mile. There is specified a drawbar pull of 32,000 lbs. The motors will be simplicity itself, the armatures being fastened directly to the axles and without gearing. Each driver can be operated singly, or they can be multiplied indefinitely and act in concert. The motors will be used in two capacities. Going down grade they will act as a brake and going up as a motive power. Upon entering the tunnel the locomotive furnace door will be thrown open and no steam used, the motor drawing or pushing the engine and train. This will avoid all smoke annoyance. In addition, the tunnel will be whitened and lit brilliantly with electric incandescent lights. Trains will be protected by electric block signals, and the tunnel will be ventilated by electric fans. Awaiting the result of this experiment in Baltimore stands the Baltimore & Lehigh Railroad. Rather than expend money at the moment for further steam power, for use in its suburban work, that road proposes to await the outcome, and if the experiment be successful, then the Baltimore & Lehigh will employ electricity as the motive power for all its suburban trains.

The speaker closed with a description of the plan proposed by Elias Reis, of Baltimore, for moving cars by electric motors actuated by induced currents, there being no physical electrical connection between the car and the underground conductor.

Mr. J. B. Stewart, of the West Shore, read a paper on "Block Signals." He spoke at length of the need of improvement, as mentioned in Mr. Ely's paper in *Scribner's Magazine* last March. Speaking of his own road Mr. Stewart said: We have track circuits, both open and closed, also electric signal circuits, normally closed. I require that a closed circuit battery be renewed every fourteenth day, no matter what its condition may be; new zincs are placed in the track battery and the cleaned zincs used in the local circuit. With this systematic way of handling the batteries, and reliable men to do the work, and to watch the circuits, there will be no failures of the electrical parts. We have been experimenting with the Beatty zinc on our track circuits with very good results. The zinc is self-cleaning

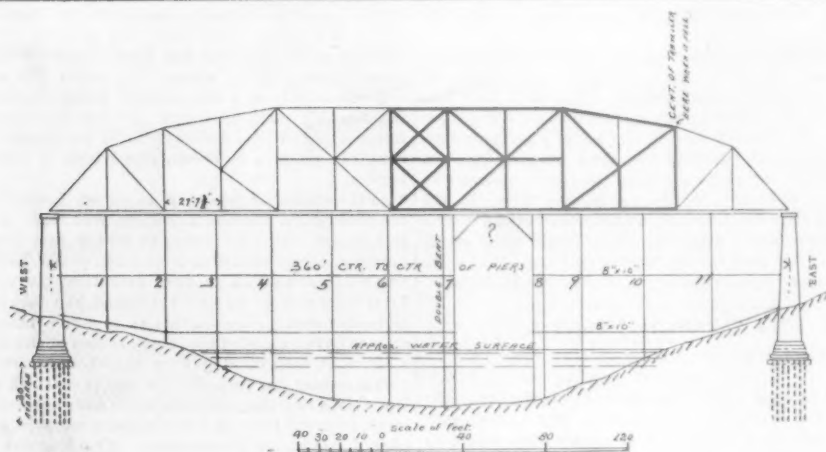


Fig. 1.

Heavy lines show the part of the trusses erected.

Licking River Bridge Wreck.

and always presents a clean surface, and, if the solution is kept at a proper strength, a uniform current is given out so that changing the adjustment of relays is unnecessary. We are also trying it on normally open circuits. We expect to use these zincs to replace Leclanché cells with gravity as they do not run out if short circuited. The first cost of the Beatty zinc is a little more, but a less number of cells is required and the zinc does its work until nothing is left but the stem. With a good and reliable battery I believe that electric signals and highway crossing bells will come more generally into use. If we require strict attention by the men in charge, our officers will soon lose their distrust of electrical appliances and recognize in them very useful and economical adjuncts to the service.

Mr. Selden stated that in Maryland the law required that either a flagman or a signal must be placed at each highway crossing. He had made arrangements to substitute bells for flagmen. His road now paid \$18,700 a year for services which could be performed for \$2,000 by the use of bells. The worst accidents they had had occurred when the watchman was asleep. In Philadelphia they had 20 crossings guarded by bells, and the only accident they had had was the killing of a horse. In this case the owner wished to have him killed, as he needed a new horse; and he got one.

Mr. Hammond stated that they had had similar accidents on the Missouri Pacific, but had not been able to prove that the bell was ringing when they occurred.

EXHIBITS.

The Leonard block signal and the Leonard train order signal were exhibited by the Electric Secret Service Co. Working models of these were shown in combination with the disc automatic selective apparatus, which was also shown in its applications to telegraph and electric light and power service.

The Edison phonograph was exhibited connected with a working wire to Cañon City. It derived its current from the Edison-Leland battery, which was also shown in various forms and sizes.

The Delaney self-winding clock was shown and explained by the exhibitor, who stated that it was in use on the Chicago, Burlington & Quincy.

The Gill-Alexander Electric Manufacturing Co. had a complete outfit of its system of selective signaling which was explained by Mr. M. C. Gillham.

Dr. A. P. Willoughby exhibited the iron gravity battery in which an iron electrode is substituted for zinc. This is the only change excepting that a secret compound is used for starting the battery when first set up. It is manufactured by the Standard Battery Co., 324 Dearborn street, Chicago.

The "Excessive Current Protector" was exhibited by I. N. Miller, and explained by Mr. Leonard.

Samples of the product of the Laminar Fibre Goods Co. of Boston were shown as prepared for track insulation, etc.

The Licking River Bridge Wreck.

BY PROF. WARD BALDWIN.

On June 15, at 10:25 a. m., the false work of the bridge being built by the King Bridge Co., between Covington on the west bank and Newport on the east bank of the Licking River, for the Kenton & Campbell County Land Co., suddenly fell. The entire false-work except one panel at the west end, the traveler, about five panels of the steel superstructure, and some 40 men were precipitated into the river. There were, as near as can be learned, 25 killed, five fatally injured, and six badly hurt.

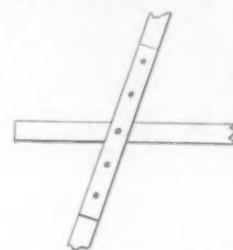
The point of failure was between the east pier and mid-span, just where is not now known. The false-work on either side of the point of failure was dragged down, the successive bents falling away from both piers and toward the opening left in the trestle-work for the passage of boats. The deck of the false-work was fastened to the coping of the east pier and in falling pulled off the corner of the pier, as may be seen in the engraving from a photograph. One stone dragged from the coping was 3 ft. x 8 ft. x 2 ft. This stone landed on the bank some 30 feet from the pier toward the river. The photograph was taken immediately after the accident occurred.

The sketch, fig. 1, shows the spacing of the bents as measured on the ground after the fall of the structure, and is only approximately correct at the east end. The heavy lines on the skeleton elevation of the truss show the part erected when failure took place. The dimensions of the truss in the false-work at the boat opening cannot be ascertained. Most of those familiar with the details

each post. (See sketch below.) A similar splice was used at top and foot of post.

The weight of the steel work erected at the time of the accident is roughly estimated at 100 tons; and the traveler weighed about 20 tons. The total weight of the finished span will be about 325 tons. The trusses are 23 ft. 1 in. wide, centre to centre, 50 ft. high at middle and are divided into 13 panels of 27 ft. 7½ in. each.

The river bed is composed of fine silt, largely fine sand. The piles were probably driven about 12 ft. into the bed of the river, but this is not authentic. The present status of the false-work is, beginning at the west end: Bent No. 1 stands complete; bents Nos. 2 and 3 have lost the top story; bents 4, 5, 9 and 7 have all the piles standing apparently uninjured, but the framed trestle bents have all fallen, one after the other toward the eastern bank. The bents east of No. 7 have all been destroyed by the falling iron except two or three piles.



As far as can be learned there was no longitudinal diagonal vertical bracing in the false work. The general dimensions of the bridge are, beginning at the west or Covington side, at the east end of the ramp there: Three deck girder spans 34 ft. 3¾ in.; one deck girder span 50 ft.; five deck girder spans 25 ft. 10½ in. long;

one 110 ft. through Pratt truss of 5 panels; one through, sub-divided panel, Pratt truss 359 ft. 3¾ in. long over the river channel; one 79 ft. 3 in. deck, quadrangular truss; seven deck, girder spans 27 ft. 2¾ in. long, and 280 ft. of pile trestle work. The spans all rest on iron columns except the channel span, which has masonry piers. The superstructure is all erected except the channel span which fell. The bridge has a roadway 21 ft. wide and two sidewalks 5 ft. each.

CINCINNATI, June 21, 1892.

The evidence now accessible shows that the pile foundation of the Covington & Newport Bridge did not give way at first. The piles in the bents near the east bank were left standing in a few cases, but were mostly broken off near the river bent. There was no idiosyncrasy in the action of the piles under the driver. They were driven with a 4,400-lb. hammer, and did not jump back when hit by the hammer, but drove as piles commonly do. The piles under the masonry went ½ in. under a 30-ft. fall of a 3,300-lb. hammer at the last blow. The traveler was not in the position shown in my Fig. 1, but is shown on inclosed blue print in correct position. [That is, exactly one panel further to the left, west, than is shown in the engraving.—EDITOR.] The truss members in the two panels [the last two of those shown in the heavy lines.—EDITOR] were being assembled, and were held by six "nigger" lines from traveler, and the upper chord of two panels (made in one piece and weighing five tons) was suspended from the traveler, and had been brought just barely into position, and the

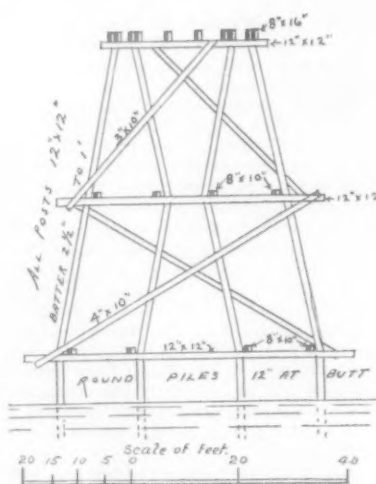


Fig. 2.

Cross-section of false work.

of the false-work are dead. Fig. 2 shows the general details of the bents of the false-work. These are framed, four-post, trestle bents of two stories, set on four piles. The sills are drift-bolted to piles; the posts were spliced by a 3 in. x 12 in. x 6 ft. plank with one bolt in the cap at the top of the first story, and two bolts in the end of



The Licking River Bridge Wreck.



INTERIOR OF THE MANUFACTURES AND LIBERAL ARTS BUILDING, LOOKING NORTH—JUNE 1, 1892.

connections were just ready to be made when the traveler broke, either through the lines fouling or from some other cause. It fell straight down, the falling iron breaking through the timbers of the false-work and the successive bents fell forward toward the breach.

An examination of the debris verifies this hypothesis as the traveler lay under the two adjacent bents of the false-work. An examination of the river bed shows that no scour has occurred. The fall of the structure was so nearly instantaneous that no time was given for very accurate analysis of the cause. One or two men were on the east pier at the time and noted the apparent giving way of the traveler, and the almost simultaneous collapse of the whole structure.

CINCINNATI, June 27, 1892.

Progress of Construction of the World's Fair Buildings.

The engravings accompanying this show the condition of the great Manufactures and Liberal Arts Building for the World's Fair at Jackson Park on June 1, 1892. The arches of the central roof trusses of the Manufactures Building are clearly shown, and indicate, to some extent, the magnitude of the work, these arches having 308 feet spread at the base. In our issue of May 20 we gave an engraving which showed the main roof trusses and carrier for erecting them. In the engravings herewith are seen the central roof trusses and also the carrier for erecting the side roof trusses, one of which is already in place. These side roof trusses span the space between the two galleries shown in the cuts. Some idea of the magnitude of this building can be gained by taking as a basis for comparison the timbers which lie in the immediate foreground, some of which are 30 ft. or more in length.

We also give an exterior view of the Manufactures building from the wooded island. It shows the method of construction and some of the scaffolding placed outside of the towers for the workmen to apply the staff covering.

Car Accountants' Convention.

The seventeenth meeting of the International Association of Car Accountants was held at the Hotel Cadillac, Detroit, on June 21 and 22. There were nearly 100 members of the Association present, more than at any previous meeting.

The meeting was called to order by C. H. Ewings, of the New York Central & Hudson River, Vice-President of the Association. In the election of officers which followed, Mr. Ewings was elected President; Arthur Hale, of the Pennsylvania, Vice-President; S. P. Sechrist, of the *Equipment Guide*, Secretary, and M. C. Trout, of the Toledo & Ohio Central, Treasurer.

The first discussion of importance was on the question of marking railroads' cars used in line trade, on which Mr. W. W. Wheatly, of the West Shore, had prepared an elaborate paper. There had been a discussion on this subject during the year by correspondence, the result of which was printed and laid before the meeting, and Mr. Wheatly's paper was largely based upon this printed discussion. The general sentiment of the meeting appeared to be that to mark cars for line trade and to exclusively assign them to such trade resulted in their making a smaller average mileage than cars not so assigned. Several members spoke very forcibly on this side of the question, especially Mr. C. P. Chesebro, of the Wabash, whose company several years ago withdrew all its cars from line business. Mr. Hale (Pennsylvania) was the only man to say a word in favor of marking cars in line service, and he apparently did not believe in the exclusive use of such cars under the direction of line managers, but appeared to contemplate their use in local trade when line trade was slack. By a viva voce vote it was resolved to recommend to the American Railway Association the withdrawing of all railroad companies' cars from line trade.

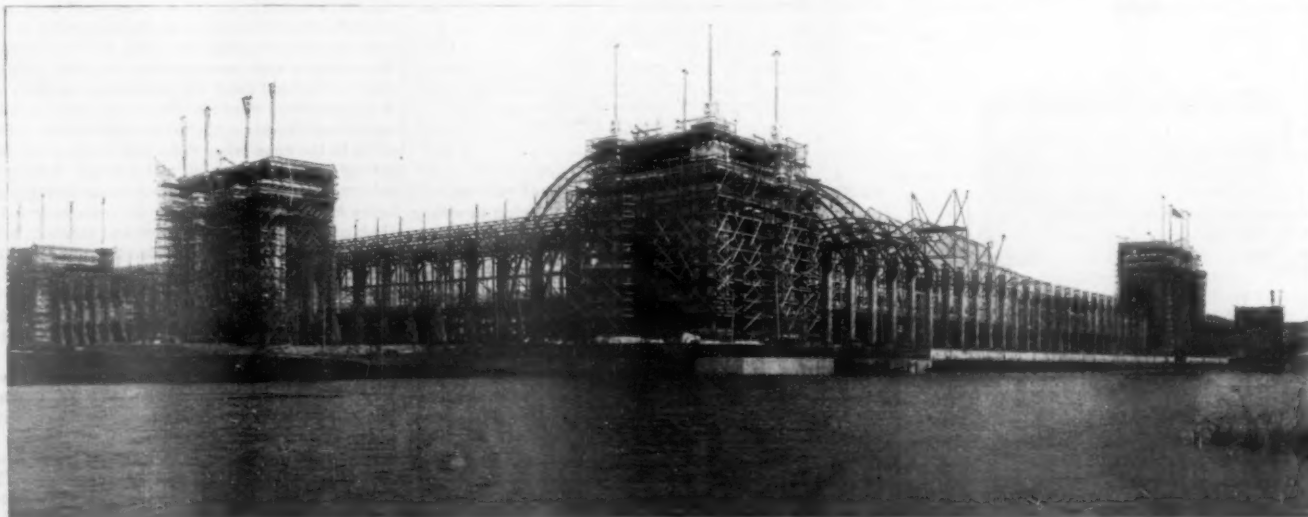
There was quite an animated discussion on the report of the Committee on Constitution and By-Laws. The Association has always made a distinction between members representing railroads and members representing private car lines and fast freight lines. The Committee had recommended admitting representatives of all lines on equal standing with railroad members. A compromise measure was introduced providing for a system of voting by "car representation," based on the method used in the Master Car Builders' Association, but after a long discussion the whole matter was referred back to a new committee, on which, it is to be noted, there were four railroad representatives and only one line representative.

The final discussion was on the undying question of per diem, which occupied the meeting till late on Wednesday night. It will be remembered that the Per Diem Committee of the Association last summer recommended

to the Car Service Committee of the American Railway Association the adoption of the mixed per diem system, on the basis of $\frac{1}{4}$ cent a mile and six cents a day. The Car Service Committee of the American Railway Association embodied this recommendation in its report, but that report was tabled. The Per Diem Committee of the Car Accountants therefore recommended that there be no further action on the subject, and it was backed up in this by the few straight mileage men left in the Association. The majority of the members present, however, appeared to think very strongly that something should be done to keep the question of per diem alive, and this took shape in a resolution, offered by Mr. Church, of the Pennsylvania Co., who proposed that in order to obtain statistics and educate the railroads of the country on the subject of per diem, it would be advisable to adopt a mixed per diem system based upon the present mileage rate, with an additional nominal rate of one cent a day. His resolution did not pledge the railroads to any action, but called for a recommendation to this effect to be sent to the American Railway Association. After the discussion had lasted through two sessions this resolution, which was at first defeated, was reconsidered and carried by a ye and nay vote of 34 to 20, only railroad representatives voting.

It was noticeable that some railroads which have heretofore been against anything like per diem, notably the Philadelphia & Reading, voted in the affirmative on this motion, while a number of vigorous straight per diem railroads, such as the Burlington, Cedar Rapids & Northern and the Chicago, Burlington & Northern, voted in the negative. The vote cannot, therefore, be deemed an indication of the strength of per diem but the fact that no one, except possibly Mr. Kouns, of the Atchison, Topeka & Santa Fe, spoke against the principle of per diem, would seem to show that the opposition to a per diem rate is stronger in the higher management of railroads than among the men who have the direct control of the cars.

The two papers read by individuals which excited most interest were one on the subject of "Tracing for Cars on Foreign Railroads," by Mr. E. B. Parke, of the East Tennessee, Virginia & Georgia, and one entitled "A Car Recording Experiment," by Mr. C. E. Wheeler, of the Lake Shore & Michigan Southern. Both of these gentlemen had experience in transportation before they took to car accounting, and in both their papers the chief end of the car accountant's duties, that of keeping



EXTERIOR OF THE MANUFACTURES AND LIBERAL ARTS BUILDING, LOOKING SOUTH—JUNE 1, 1892.

control of his cars and using them to the best advantage, was never lost sight of. Mr. Parke's appeal for moderation and the use of common signs in tracing for cars was very generally commended, but his animadversion on the neglect of some car accountants to regard reasonable tracers met with a *tu quoque* in the discussion that followed, which was perhaps a little warmer than he expected. His conclusion was that really the only satisfactory tracer was one by wire and it is undoubtedly true that much of the tracing by letter which car accounts indulge in never catches up with the car. Probably the better solution would be a telegraphic junction report which would render much of the present tracing unnecessary.

Mr. Wheeler's paper gave in detail an account of the system by which he is now recording the movements of his cars. A number of roads have for some time been recording the movement of each car on foreign railroads on a card instead of in a book, shifting these cards from one pigeon-hole to another as the car moved from one railroad to another. Under this system a glance at the pigeon-holes will show, in a rough way, the number of cars on each railroad; but Mr. Wheeler has taken a step in advance of this system by mounting his cards on thin wooden blocks, and having the car number painted on the end of each block so that by glancing over his case of pigeon-holes he can tell not only in a rough way the number of cars on each railroad but exactly which car is on each railroad. It was indicative of the interest that the car accountants took in Mr. Wheeler's paper that while he was delivering it, it was almost impossible for the chairman of the Committee on Arrangements to announce his very attractive programme of the next day's excursion, despite the efforts of the Chairman to secure him a hearing.

Another interesting paper was read by Mr. C. W. Cushman, of the Railway Car Association, who gave a short history of that association, which was of especial interest to many new members. It seems that Messrs. F. M. Luce, C. W. Cushman and C. P. Chesebro have attended all the 17 annual meetings of the association, in which there now remain barely half a dozen of the original members.

The Committee on Arrangements, to whom is intrusted the excursions which usually follow the meetings of the association, were ably seconded by a Citizens' Committee, of which Mr. Fortune, of the Chicago & Grand Trunk, was chairman. On one afternoon 30 or 40 open carriages were provided, in which the members of the association, with their families, were taken on a drive round Bell Isle; and the next day, after looking through the Michigan and the Peninsula carshops, they sailed on the river in quite a flotilla of steam yachts, including those owned by General Alger, Senator McMillan and other distinguished citizens of Detroit.

After adjourning, a special train took the Car Accountants to and through the St. Clair tunnel, and they returned on the steamer "Greyhound" to Detroit, where they separated, to meet next year at Old Point Comfort.

The Gibbs Electric Connector for Car Lighting.

In lighting railroad cars by electricity with a series of conductors running the length of the train, the conductors are provided at the ends of the cars with coupling devices generally known as "connectors," each adapted to establish connection between the several conductors on one car and the corresponding conductors on the next one. The practical requirements are: Sufficient conducting capacity to carry the current without heating; simplicity so that the connection can be quickly and conveniently made; accessibility for examination and repair, and weather tight joints.

The three-wire connector shown here is used on the electrically lighted trains of the Chicago, Milwaukee & St. Paul. The connector is made in two parts; the con-

nectors, figs. 3, 4 and 5, and the plug, figs. 6, 7 and 8. Figs. 1 and 2 show the connector uncoupled and coupled. The connector is made with a gutta-percha box, open at one end, having within it three spring contact pieces, C, C, C, figs. 3, 4 and 5, properly insulated. Surrounding the connector at the open end is a brass casting, A, having lugs by which the connector can be attached to the hood of a

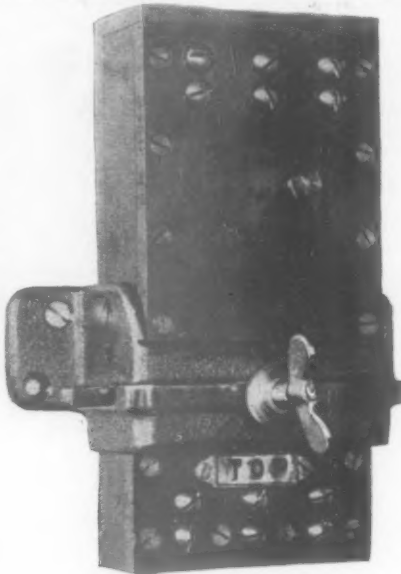


Fig. 2.

car. A thumb screw, D, with a joint nut, E, figs. 3, 4 and 5, acts upon a clamp with an insulated face resting upon the contact pieces, C, C. The clamp has lugs fitted into grooves in the hard rubber of the surrounding box to keep it in place. For completing the circuit on the last car a brass disc, G, figs. 3 and 5, with a shaft, is placed above two of the contact pieces and within the insulating box. The longer end of the shaft is threaded and fits into an insulated brass boss H, fig. 5, attached to the outside of the box. The shorter end of the shaft J, figs. 3 and 5, is milled square and projects through the box to receive a key. The edge of the disc G is milled, and against it is placed a spring S, figs. 3 and 5, to keep the disc in whatever position it may be placed. To complete the circuit the disc is screwed down until it bears against the contact pieces. The plug, figs. 6, 7 and 8, is made of three solid brass pieces P, P, P, figs. 7 and 8, spaced so as to register with the openings in the connector and engage with the contact pieces. Between

connector are employed elastic contact strips, which give a moderate initial contact-pressure, in combination with clamping devices, whereby pressure may be applied to insure firm contact of the conductors. Older forms of connectors which depend entirely upon elasticity for electrical contact, were found to be unreliable, for the reason that the current carried in train lighting is considerable. It takes a large and perfect surface contact to prevent the connector from heating. Since this device was put in use heating has been entirely unknown. It is strong, compact and well made, and was adopted after two years trial and experiment. The present form meets all practical requirements so far found. It is the invention of Mr. George Gibbs, Mechanical Engineer of the Chicago, Milwaukee & St. Paul Ry.

Compound Locomotives.

SUMMARY OF THE REPORT OF THE COMMITTEE OF THE MASTER MECHANICS' ASSOCIATION.

As the general subject of compound locomotives had been ably discussed in the report upon this subject presented two years ago, it was considered most desirable to present, at this time, results of tests made under comparative conditions and with full personal knowledge of the facts; these tests to be carried out in a true scientific spirit and without any attempt to establish previously formed judgments. For many reasons it was found impossible to arrange for so complete an examination of the subject as is desirable, and the tests made under the direction of the committee were confined to the four-cylinder type of compound locomotive in freight service. All the needed facilities for the tests were offered by the C. M. & St. P. Ry. Co., without regard to the expense or inconvenience entailed. For locomotives, two of the C. M. & St. P. Ry. standard class "D" freight type were ordered of the Baldwin Locomotive Works. These engines were to be identical in every respect, with the exception of the features necessary to the compounding. The general dimensions of these engines are as follows:

	Compound, 897.	Simple, 822.
Cylinders, diameter	12 and 20 x 26	18 x 26
Stroke	12 and 20 in.	26 in.
Firebox, size inside	6 ft. 6 in. x 2 ft. 10 in.	6 ft. 6 in. x 2 ft. 10 in.
Firebox, depth	6 ft. 5 in.	6 ft. 5 in.
Tubes, 191, 2 1/4 in. diameter, length	13 ft. 7 1/4 in.	13 ft. 7 1/4 in.
Diameter of drivers	5 ft. 2 in.	5 ft. 2 in.
Exhaust nozzle	3 3/4 in. double	3 3/4 in. double
Heating surface, total, sq. ft.	1,712.1	1,712.1
Weight on drivers	87,970	86,200
Weight on trucks	34,430	33,800
Weight, total, in working order	122,400	120,000

General Description of Tests.—All tests were planned to show the relative economy of the engines under the

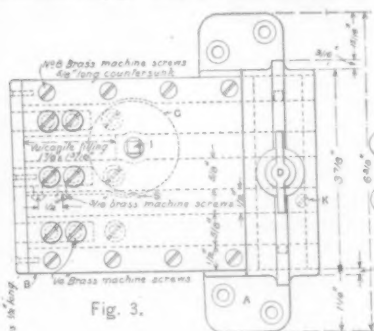


Fig. 3.

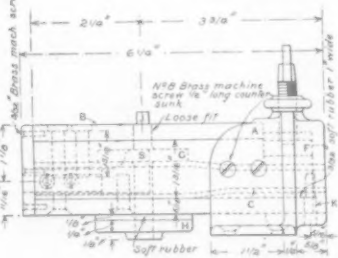


Fig. 5.

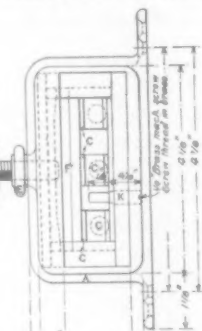


Fig. 4.

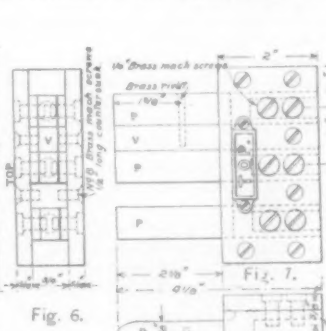


Fig. 6.

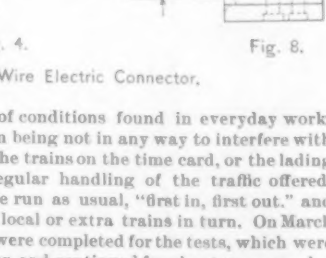


Fig. 7.

Gibbs' Three-Wire Electric Connector.

wide variations of conditions found in everyday working, the intention being not in any way to interfere with the schedule of the trains on the time card, or the lading resulting from regular handling of the traffic offered. The engines were run as usual, "first in, first out," and thus fell to haul local or extra trains in turn. On March 31 preparations were completed for the tests, which were accordingly begun and continued for about seven weeks, or up to the time when data was needed for the report, giving in all 60 trips of 92 miles each. Two crews were selected to handle the engines; these were picked out as being careful and observing men, accustomed to work their engines with intelligence and method, and the results proved that a better selection could not have been made. In order, however, to neutralize as far as possible the "personal equation" of the men, the crews were run alternately on each engine, and the results show the handling of both the simple and compound engine with each crew.

The route selected for the test was the east end of the La Crosse Division from Milwaukee to Portage, a distance of 92 miles. One-half mile from Milwaukee the heaviest long grade on the line is met, being approximately 47 ft. to the mile of 4.5 miles. This grade is the limiting one for weight of westbound trains. The road from there to East Rio, 77 miles from Milwaukee, is an undulating succession of short grades and level stretchers; from East Rio to Portage, a sharp descent of eight miles is encountered. For eastbound trips the limiting

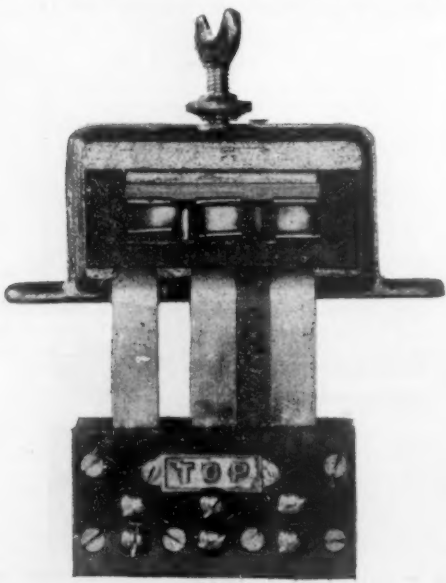


Fig. 1.

two of the plugs is placed a strip of hard vulcanite V, figs. 6 and 7, so as to prevent putting the plug in wrong side up. Unless the plug is entered right this vulcanite filler strikes a stop K, figs. 3, 4 and 5, placed between two of the contact pieces in the connector.

In service one of the connectors is permanently attached to the car under each hood. The two plugs are fastened together with about 38 in. of flexible wire and make the connection from car to car. In making up the connections the plugs and connectors are placed as indicated in figs. 1 and 2. When the plug has entered the connector a few turns of the thumb screw forces the clamp upon the contact pieces and binds the whole together, thus insuring a perfect contact and preventing the plug from falling out.

Other connectors in use are generally combinations of fingers, either rigid or elastic, which are slipped into one another, reliance being placed upon the moderate pressure of the spring to maintain the contact. In this

grade is found between Wyocena and East Rio. This grade is the worst on the division, but being shorter than the "Soldiers' Home" grade, and in a position admitting a "run for the hill," is easier surmounted than the latter.

A dynamometer car built for these tests was run directly behind the engine on each trip. Samples of the continuous diagrams obtained are illustrated herewith, the cut being a direct reproduction from a photograph of the original diagram.

The apparatus contained in the car consists of the well known arrangement of recording apparatus, which measures continuously the compression of the draft springs and traces the same (line D), by a pen in contact with a continuous roll of paper, which is kept in movement by a geared connection to the car axle. The car wheels imparting motion to this apparatus were turned with cylindrical bearing surface on the rails, so that the speed of rotation of paper on the registering drums was exactly proportional to that of the car, irrespective of endplay of the axles.

The speed of train was obtained by means of another pen, attached to the armature of an electromagnet and drawing a line (A) on the paper; at intervals of five seconds impulses were sent through this magnet from an electric contact on a clock, and caused the pen to jog inward and make a dash at right angles to the straight line; the distance between these five-second dashes,

sible to gauge the amount of coal necessary for a trip quite closely, but an extra supply was carried in bags containing 250 lbs. each for use in case the supply of loose coal became exhausted.

The feed water was measured by two Thomson water meters, one on each side of the engine in the suction pipes of the injectors. The steam pressure was recorded by an Edison recording gauge. The speed was determined by a Boyer speed recorder and also by the electric contact marks on the stress diagram paper. The dryness of steam was determined on four trips by means of a Barnes calorimeter. The waste from the injectors was measured for a large number of times and the average waste thus determined was deducted from the water meter records. The waste from blowing off at safety valves was determined by a special test and found to amount to an average of 108 lbs. of water or steam per minute popping. The temperature in the smokebox was obtained by means of a Weiskopf pyrometer. The cut-off was taken at the reverse lever notches which were calibrated. Indicator diagrams were taken on four trips, on which the vacuum in the smokebox was also observed.

Notes Upon the Tests.—The full records of the tests were tabulated in seven tables, giving the general conditions of test, the trip data, table of general averages, the general conditions of working each engine on each trip, including miles run at each cut-off and time the

from $\frac{1}{2}$ to $\frac{3}{4}$ of the entire distance run. According to instructions, the men had been taught to work the engine much the same way as a simple engine, that is, at as short a point of cut-off as possible. Failing to get sufficient power to do the work under these conditions, the starting-valve was used. On explanation from Mr. Vauclain, the method of handling the engine was radically changed, the reverse-lever being dropped toward the corner as the train requirements increased, and the starting valve only used in the corner, and as a last resort.

Although these first trips cannot be taken in estimating the general performance of the compound engine, it was thought a useful purpose would be subserved by showing them in separate form in the tables; they clearly demonstrate the nice working conditions for which economy in compound engines depends, and also the poor results which may be obtained by a careless engineer. As the result of this experience and further observation, your Committee are of opinion that it is advisable to make some modification in the starting-valve rigging; as now arranged, it may be opened for any distance while running and when reverse lever is in any notch; it would seem preferable to arrange so that it can be only opened when reverse lever is in corner, and that when the same is hooked up the starting-valve will be shut.

In working the engines it soon became evident that the compound at 180 lbs. pressure was not as powerful a machine as a simple engine at the same pressure. The Baldwin Locomotive Works, when informed of this stated that they had built the compound to carry 200 lbs., clearly a misunderstanding of the Committee's wishes in the matter, which were to have all the conditions as far as possible identical. The test records will show that the Committee have attempted to remedy this unfortunate mistake by running both engines at 180 and 200 lbs. pressure alternately. The simple engine, however, does not derive the full benefit of this increased pressure, and could not be worked with it successfully on account of trouble with the valves running dry. In the "compound" this defect did not appear, as the piston valve used is very perfectly balanced.

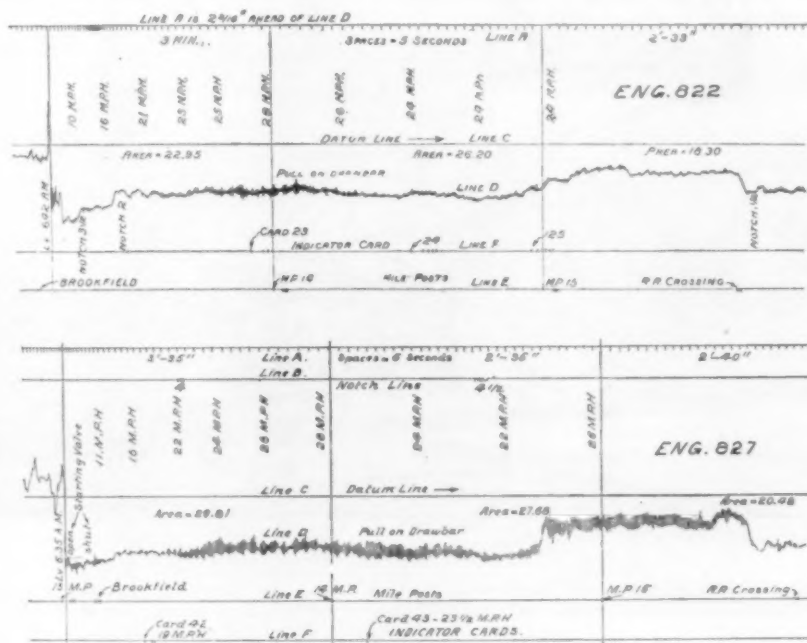
As the difference in the total pressures upon the pistons in the Vauclain type of compound locomotive has been generally commented upon, it was thought best to plot these pressures as shown by a number of indicator cards selected by the committee as being fair representative cards. The diagrams for early cut-off and high speed show but very small differences in the total pressures on the high-pressure and low-pressure pistons during the greater part of the stroke. Other diagrams are given in the report showing the variation in rotative pressures on the crank pins, including the inertia of the reciprocating parts, from typical indicator cards from the two engines tested and from a Schenectady two-cylinder compound. The supposed greater uniformity of the turning moments in the two-cylinder compound is not substantiated by these diagrams.

Remarks on the Results of Tests.—The condition which will be considered of first importance by railway managers is ability to handle a varying traffic with certainty and economy; this involves a relative consideration of first, interest account on first cost; second, the monthly repair bills; third, the monthly fuel and small supplies bills. It is therefore apparent that averages must be sought, and that individual trips are only of importance in fixing the economical range of the engines, and thus enabling us to figure out the best proportion of parts.

Comparisons can be made on two bases, the coal and water consumed per ton hauled one mile, or on the amount of work done per unit of coal and water. The first will be found on Table No. 7,* grouped under "Train Results;" the second under "Dynamometer Results." These last are considered the more exact for comparison, and of these preferably, the figures for coal and water per horse power hour, which not only give results based on total amount of work done, but include the speed factor or rate of doing work. As showing the reason for this conclusion, attention is called to Table No. 7, lines 24 and 37, from which is seen that the saving of coal per ton-mile by the compound on east-bound trips is $3\frac{1}{2}$ times that on west-bound trips, while the saving in coal per horse power per hour is in the ratio of about $1\frac{1}{2}$; on the west-bound trips (see table No. 3^a) the train consisted of 29 loaded and 2 empty cars and weighed 583 tons, while east-bound, 26 loaded and 7 empty cars weighed 734 tons. Differences of like nature will be found in other trips, and the number of loaded and empty cars is, therefore, no indication of the work actually done.

Two important divisions of the tables are those giving results with use of Braceville and with Pittsburgh coal. The former may be considered a fair example of good western coal, used by roads in the territory west of Chicago. The main portion of the test was therefore conducted with this coal. In order, however, to test the steaming qualities of the engines with the best sample of Pennsylvania coal, it was decided to make a few trips with Pittsburgh coal.

Much has been said about the characteristic exhaust obtained from the compound locomotive. In the two-cylinder compound especially, there is obtained one pulsation of exhaust to two in the simple engine. The character of this pulsation, as observed by the sound of



Diagrams with Report of Master Mechanics' Committee on Compound Locomotives.

measured in sixtieths of an inch, gave the speed of car in miles per hour.

The location of the mile posts, stations, etc., on the diagram (line E), was obtained by means of another pen similarly connected to a magnet and caused to make a jog in the line when the attendant pressed a push-button at the window. The position of the reverse lever in a cab was registered on the diagram in car (line B) in the same manner, by pressing push-button giving connection with the cab by cable. The datum line (line C), from which the height of stress-diagram was measured, was drawn by a fixed pen, adjusted to be coincident with pen A when the latter registered the position of zero pressure on the draft springs. When indicator cards were taken an additional marking was adjusted on the paper and was arranged to give a mark when electric contact was made at the indicator in taking a card (line F). The main stress-diagram obtained on the moving paper was on scale of one foot to the mile.

The number of strokes made by the air-pump was registered in dynamometer car by means of electric impulses sent from the contact apparatus attached to the locomotive air-brake pump. This recording device is substantially a clock movement, in which the balance wheel or pendulum has been removed, and the escapement operated by the pull of a magnet armature; movement of this escapement turned the hour and minute hands, and the number of double strokes of air-pump were in this way measured by reading off the differences in time registered during the trip, multiplying the same by movement of hands for one stroke. The amount of steam (or water) consumed per stroke was taken as $\frac{1}{10}$ lbs., a figure determined by experiment and kindly furnished by the Westinghouse Air brake Co. This figure is somewhat less than the actual weight of one cylinder full of steam at given boiler pressure, which fact is accounted for by wire-drawing in passages, etc.

Further communication between locomotive cab and dynamometer car was established by an electric bell and speaking tube.

The coal for each trip was weighed by the barrow full on a platform scales and dumped into a chute from which it was loaded on the tender. It was found pos-

sible to gauge the amount of coal necessary for a trip quite closely, but an extra supply was carried in bags containing 250 lbs. each for use in case the supply of loose coal became exhausted.

The feed water was measured by two Thomson water meters, one on each side of the engine in the suction pipes of the injectors. The steam pressure was recorded by an Edison recording gauge. The speed was determined by a Boyer speed recorder and also by the electric contact marks on the stress diagram paper. The dryness of steam was determined on four trips by means of a Barnes calorimeter. The waste from the injectors was measured for a large number of times and the average waste thus determined was deducted from the water meter records. The waste from blowing off at safety valves was determined by a special test and found to amount to an average of 108 lbs. of water or steam per minute popping. The temperature in the smokebox was obtained by means of a Weiskopf pyrometer. The cut-off was taken at the reverse lever notches which were calibrated. Indicator diagrams were taken on four trips, on which the vacuum in the smokebox was also observed.

Notes Upon the Tests.—The full records of the tests were tabulated in seven tables, giving the general conditions of test, the trip data, table of general averages, the general conditions of working each engine on each trip, including miles run at each cut-off and time the

starting valve was open; a description of the trains and general analyses of coal used, and the percentages of saving by use of the compound. The table of general averages and that giving the percentages of saving has been published in the *Railroad Gazette* in connection with the discussion upon the report.

For comparative economical results, chief reliance was placed on the dynamometer car record, but in order to obtain figures for economy on the basis ordinarily given in tests elsewhere the exact weight of the train hauled was computed. These weights were obtained by getting the marked light weights of the cars and the weights of loads from the bills of lading. Where these were not accessible the cars were weighed on platform scales at end of run. Freight taken on or off at intermediate stations was kept account of in figuring the total in miles. The weights thus obtained may be considered quite accurate enough for practical purposes. The light weights of the cars are probably in slight error, as cars commonly drew out a small amount, depending upon the time out of shop.

As a standard unit of comparison of engine performance, the number of foot tons of work done per pound of coal and water in hauling the train in each case was taken. This figure, while not free from small errors, is probably practically correct.

Calculation of dynamometer work was made by measuring with a planimeter the area inclosed between the irregular line D, drawn by the pen connected with the drawbar spring, and the line of zero tension, or base line C. From this area the mean height of the line B above the base line was obtained, and thus, by comparison with the corresponding deflection of the drawbar spring, the pull on the drawbar during this time. The figure multiplied by the time consumed in making the diagram gives the number of foot pounds per trip, which, divided by 2,000, gives the number of foot tons per trip.

Four round trips made by the compound engine during the first week of the test are not included in the general results, as they give an erroneous idea of the economy of the engine, for the reason that it was handled improperly during this time. This will be evident when it is seen that the starting-valve was open on these trips

* See *Railroad Gazette*, June 24, 1892.

the exhaust and by the vacuum in front end, is very different from that of the simple engine, and tests with the two-cylinder compound, previously made, had shown a certain percentage of steam economy obtained, and an additional percentage of fuel economy, indicating that the softer exhaust was in some way responsible for more efficient combustion. In the four-cylinder compound, while the pulsations are of the same number as in the simple engine, it was thought the difference in volume of steam discharged from the low pressure cylinders and its lower average terminal pressure, might exert a similar action on the fire, so that while the compound might show fuel economy with the free burning, clinkering western coal, it might give very different results with the hard Pittsburgh coal. It is, further, well known that, on account of the clinkering properties of the western coal, to successfully burn it and prevent clogging of the grate bars, a sharper exhaust must be used than is needed for the non-clinkering eastern coal. It, therefore, seemed reasonable to suppose that the softer exhaust in the compound would operate to disadvantage in burning the western coal; hence the results shown in tables are somewhat unexpected.

It will be seen that the size of the nozzles used for the two engines was different. The C. & M. & St. P. Ry. standard nozzle is double, 3½ in. diameter, and has been carefully designed to produce the best steaming with the kind of coal employed. The compound originally fitted with this nozzle did not steam freely with Braceville coal until the nozzle was reduced to 3¼ in. With Pittsburgh coal it could be enlarged to 3½ in., but no more.

The effect of using Pittsburgh coal in the two engines is shown in the following table, which gives the percentage of economy so obtained in each engine as compared with its performance with Braceville coal:

Engine No.	Coal per H. P. hour.	Water per H. P. hour.
822 (simple)	28 per cent.	9.2 per cent.
827 (compound)	19 " "	6 " "

It is thus seen that in changing from Braceville to Pittsburgh coal the improvement in economical performance was greater with the simple than with the compound engine. In the opinion of your committee the explanation of the greater improvement of the simple engine is that with the friable Braceville coal its sharp exhaust, as compared to that of the compound, caused a considerable proportion of the fine coal to be drawn through the flues unconsumed. With the harder Pittsburgh coal this did not obtain to so great an extent in either engine, and it necessarily follows that the gain from suppression of waste would be more marked with the simple engine, as is shown in the table. As a consequence, your committee feel justified in predicting that in future trials the greatest gain in compounding will be found where coals used are of a dusty or friable nature.

Referring to the tests with Pittsburgh coal, and to the column for saving of coal per horse power hour, it will be observed that where both engines were tested at 180 lbs. pressure the results show a very slight economy for the compound. Examining the tables from which this figure is obtained, it would appear that the engines were working under almost similar conditions. The only explanation of the result which your committee has to offer is that for this steam pressure and train the compound was overloaded, and this opinion is strengthened by the figures shown in line 28, where the simple was worked at 200 lbs. and the compound still at 180 lbs. In this case it will be seen that the percentage of compound economy is negative—in other words, the simple was the more economical of the two.

It is but fair to say that in the opinion of your committee the performance of the compound will in prolonged practice be better than above shown, were it worked at its economical steam pressure. Referring to line 24, where both engines were worked at 200 lbs., the economy is 6.1 per cent. Examination of the train conditions will show that all were reasonably within regular service limits, and, therefore, would seem to fairly represent what may be expected with this class of fuel under average conditions. It will be observed, comparing results with each engine with itself at the two pressures, that, while the simple engine shows at the higher pressure a gain in economy of 6.2 per cent., the compound shows a gain of 10.8 per cent. This, it is thought, explains the apparently abnormal increase of 11.9 per cent. of the compound at 200 lbs. with the simple at 180 lbs., as shown in lines 25 and 26; but it is not to be understood that in their opinion the simple engine will really gain in economy throughout by increase in pressure—at least this conclusion cannot be substantiated by these tests.

As a final average economy with Pittsburgh coal, it is their opinion that line 22 should be thrown out, leaving the average economy westbound as 6.1 per cent. and eastbound as 9.2 per cent., or a final figure of 7.6 per cent.

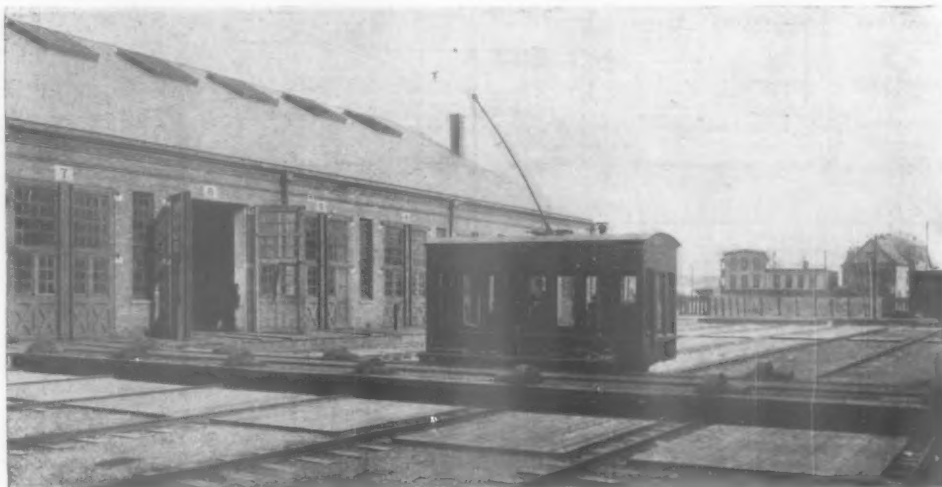
It seems probable, as a general review of the entire question, that the results given with Pittsburgh coal represent the simple engine at its most favorable condition. On the other hand, they are strongly of the opinion that the large number of trips represented by the tests with Braceville coal quite nearly approximate the condition laid down as most desirable at the outset of the report, that is, average monthly or yearly economy, to be derived from compound engines. This figure is shown to be 16.9 per cent. coal and 14.1 per cent. water economy.

Tests on Other Roads.—Under this heading are given the results of comparative tests of two-cylinder compound and simple engines upon the Southern Pacific and Old Colony Railroads. The S. P. tests show saving by the compound, Schenectady, of from 7.38 to 24.5 per cent. in coal per ton-mile, and from 6.24 to 22.3 per cent. of water per ton mile.

Electric Transfer Table Industrial Works.

The transfer table shown in the illustration is a design embodying several novel features in its construction. The depth of pit in which it may be operated is reduced to a minimum. This is easily accomplished in the construction of tables of small capacity and short lengths. The above table is, however, of 75 tons capacity and 70 ft. long. In the detail of construction the endeavor has been to make the machine of high speed in all its motions, and to this end, for the reduction of friction and power required, all supporting framework journals have hard steel roller bearings. The number of them and the distribution of the load insures durability. This table with a 50-ton load may be propelled with less than three horse power.

Upon the axles of the ground, flat-tread, 24-in. wheels are hung in pairs, heavy forgings of rectangular section, and upon these rest a special heavy section of 10-in. deck beams, which serves as a track for the load, and the chords of truss which secures the transverse stiffness of the framework. The propelling and supporting shafts



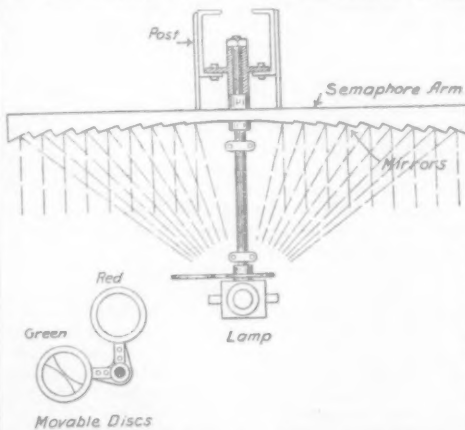
ELECTRIC TRANSFER TABLE.

are continuous, and altogether this framework is of great strength and stiffness, and allows the use of the shallow pit.

The motive power for the machine is through a 25 H. P. motor, of more than the necessary power for propulsion, but made of this capacity that it may be able to pull quickly from a distance several coaches coupled to the leader tracks of the table. There are two speeds for propulsion, either operated through friction clutches; also a powerful pulling on and off attachment. The illustration is from a table recently installed in the Buffalo works of the Wagner Palace Car Co., by the Industrial Works of Bay City, Mich.

A French Illuminated Semaphore Signal.

A new type of semaphore signal, described in a recent number of the *Revue Generale des Chemins de Fer*, and approved by the French Government in September, 1890, has been adopted by the Eastern Railroad of France.



The accompanying sketch is almost self-explanatory. Each arm of the signal is provided with small silvered glass mirrors set at such angles that the reflection of the signal light will make a continuous band. The lamp is fixed, the change in color being made by the automatically moving colored discs in front of the lamp at the same moment the switch is thrown.

The colored glasses may be provided with diaphragms

in each of which is a slit. In the sketch of movable discs, the green glass has such a one. By this device only a narrow band of light passes through and the light of one signal cannot affect that of another near it on the same mast, as often happens when many lights of the ordinary kind are arranged in close proximity.

This signal can be clearly seen about 1,300 ft. by day or night. The price in France, not erected, is about 663 francs, or at 20 cents per franc, \$132.60.

Twelve Passengers Killed on the Pennsylvania.

A disastrous rear collision which occurred in Harrisburg, Pa., on the Pennsylvania road, at 12¼ o'clock on the morning of June 25, resulted in the death of 12 and the injury of 23 passengers. The first section of west-bound express train No. 9 was stopped at Dock street, just east of the Harrisburg station, on account of switching being in progress on the main track; after a short delay the flagman who had been back was called in and it started again, but had proceeded only a few hundred feet when it was run into at the rear by the second section, which, owing to the view being short, came on at high speed, probably 40 miles an hour. At the rear of the first section was the private car of Mr. George Westinghouse, occupied by Mr. Westinghouse and his family and Mr. Robert Pitcairn. This car was badly crushed at the rear end, but none of the occupants were hurt except the porter, and he only slightly. The

shock was transmitted to the three-day passenger cars ahead of the Westinghouse car, and these were badly broken up, causing the deaths and injuries above noted. The details of the disaster were particularly heart-rending. No trainmen were injured, though there were several employees among the injured passengers. The first car in the second train was badly wrecked.

Steelton is the block-signal station next preceding Dock street, and the operator there acknowledged before the coroner that he admitted the second train to the section without first receiving authority to do so from the operator at Dock street. He called Dock street, but got no response, and then, it appears, deliberately took the risk. This operator, H. S. Hayes, is a young man of 22, and is said to be an extra man who has been at work but a month or two. He is described as an unsophisticated youth, lately from a farm in York County. In admitting his error, he stated that he had company in the tower (a track walker and another) which was contrary to the rules. He was terribly agitated at the inquest.

But notwithstanding Hayes' negligence, the foreman train cleared that block section in time to prevent the collision, and the immediate cause of it was the negligence of the engineman of the second train, Kelly, who failed to stop at the Dock street signal, which was at danger. Rain was falling very fast at the time and Kelly claims, according to report, that he could have stopped if the track had been dry; but this seems doubtful as he struck the other train only about 180 ft. beyond the signal and apparently with great violence. It appears that there is no distant signal at Dock street, but the home signal there is often used to caution passenger trains at all hours of the day and night, so that Kelly's failure to approach under control, according to rule, seems to have been a flagrant case of negligence.

Robert M. Brown, the flagman of the first train, claims that he placed torpedoes on the rail, but Kelly says he heard none. The standard code, in a case like this, requires, in substance, that the flagman shall make sure that his red light is visible a certain distance to the rear (2,700 ft. on the Pennsylvania); this rule is in force for a certain time (one minute on the Pennsylvania) and then he must go a certain distance (3,600 ft. on the Pennsylvania) and put down torpedoes, and, a passenger train being due, he must not come in, even if called by the whistle. Brown did come in; but the reports do not state whether the stop was more or less than one minute.

Rod Boring Machine.

This is a machine especially designed for boring parallel rods for locomotives and built by the Niles Tool Works, Hamilton, O. It has high power and will bore both ends of the rod at the same time, thus allowing the work to be done in duplicate with great uniformity. The housings are double-webbed, with the cross-rail and work-table rigidly secured to them. The cross-rail has a width on the face of 20 in. and the boring-head saddles have bearings on it 26 in. long. The saddles are quickly adjusted to position on the rail by means of rack and pinion, operated by a "T" wrench. Their relative positions once being determined for the work to be done, the saddles are firmly clamped in place.

The boring spindles are $3\frac{3}{4}$ in. in diameter, having a vertical traverse of 14 in. and a range between centres of from 3 ft. to 10 ft. Both spindles are counterbalanced by a single weight, in same manner as the tool-bars on the Niles boring and turning mills. This device permits an adjustment of the saddles without moving the weight, and does not burden the saddle or rail with additional weight to secure the counterbalance.

Three changes of feed are available for each spindle without the change of gears, ranging from $\frac{1}{16}$ in. to $\frac{1}{8}$ in. to each revolution of spindle. Spindles have rapid hand

and was burned up. The passenger train was pushed violently forward and the engineer was injured. The sleeping-car conductor was injured by jumping.

2d, Atchison, Topeka & Santa Fe, near Oklahoma City, O. T., a freight train, which had been suddenly stopped by the rupture of an air brake hose, was run into at the rear by a following freight, wrecking an engine and a dozen cars of cattle.

10th, on Wilmington & Northern at Greenville, Del., rear collision of freight trains derailing several cars. There was a carload of gunpowder in the train, and it is said that the kegs were broken open, but no explosion occurred.

10th, on Chicago & Northwestern at Winfield, Ill., a passenger train which was flagged to stop at the station ran some distance beyond and was then set back; just as it got back to the station it was run into at the rear by a following freight train. The freight engine and several cars were damaged and one passenger badly injured.

17th, on Philadelphia & Reading, near Parkland, Pa., a freight train standing at a water tank was run into at the rear by a following freight, wrecking engine and several cars. Engineer and fireman badly injured.

20th, on the Pennsylvania road, near Metuchen, N. J., a freight train ran into the rear of a work train ahead of it, badly injuring the conductor.

23d, on Southern Central at Nanticoke, Pa., a coal train broke in two and the two parts afterward ran together, derailing 12 cars. A brakeman was injured.

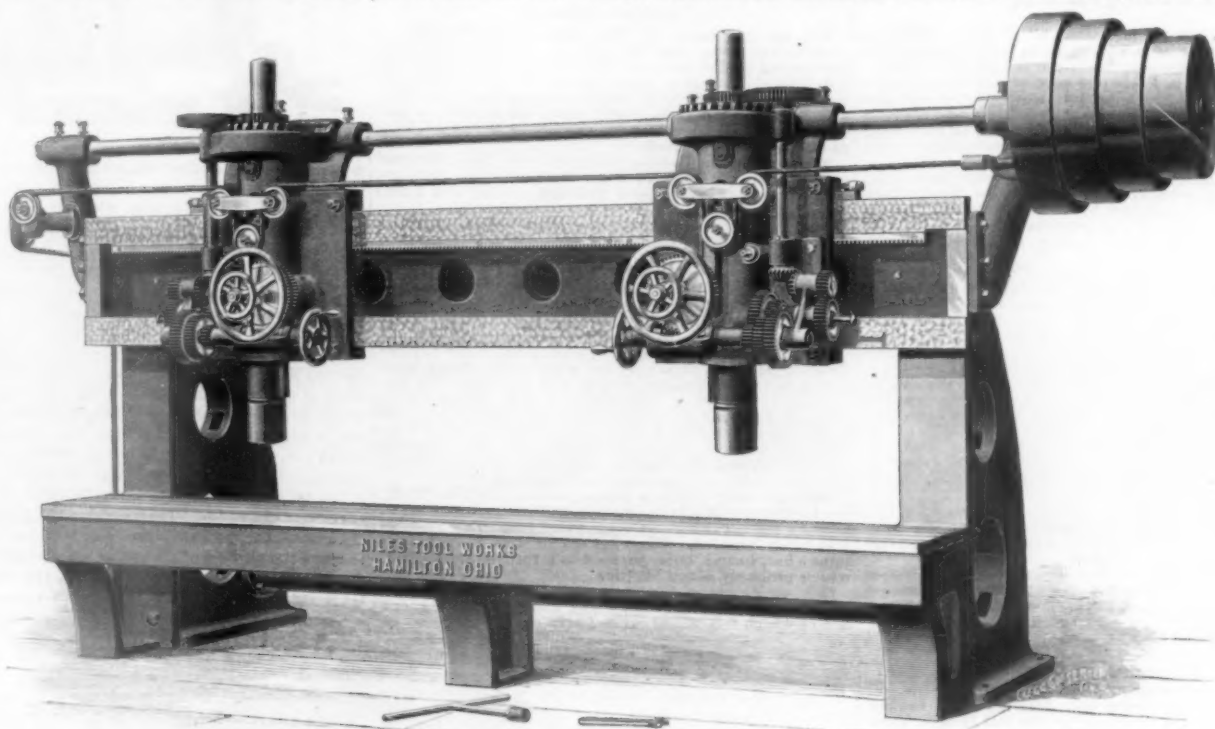
24th, on Chicago & Northwestern at Dow City, Ia., a gravel train ran over a misplaced switch and into the

Eddy, N. Y., butting collision between a northbound freight and a southbound coal train, wrecking both engines and several cars. Engineer fatally injured. It is said that a red light hung out by the operator to stop the northbound train became extinguished, and that this was the cause of the collision.

15th, on Cleveland, Cincinnati, Chicago & St. Louis, at Cleves, O., butting collision between an eastbound passenger and a westbound freight train, wrecking both engines, 5 freight cars and the first 2 cars of the passenger train. A fire started in the wreck but was extinguished by the town fire department. Five trainmen and 1 passenger were killed, and 3 trainmen and 12 passengers injured. A new time-table went into effect on the morning of the 15th, and it seems that the freight engineer and conductor both forgot the change in time of the passenger train. Both of these men were killed.

15th, on Chicago, Burlington & Quincy near Red Oak, Ia., butting collision between a freight and a passenger train wrecking both engines, 8 freight cars, and one baggage car. Engineer killed and 2 other trainmen injured.

20th, on St. Louis Southwestern, near Golden, Ark., a passenger train which, in consequence of a flood over the track, had been ordered to run some distance backward was wrecked by a butting collision with a freight train, which was met on the trestle. The sleeping car received the worst of the shock and was overturned into the water. The whole of the passenger train was much damaged. One trainman and 8 passengers were killed, and 20 passengers were injured. A steamboat had to be sent from Pine Bluff to rescue the survivors and secure the dead bodies, as the wide spread flood cut off access



BORING MACHINE FOR LOCOMOTIVE RODS.

Built by NILES TOOL WORKS, Hamilton, Ohio.

motion to facilitate setting, and are provided also with slow hand feed. The spindles are always driven together, but the feed is independent for each.

The machine is designed for boring diameters ranging from 3 in. to 7 in. The cone has four steps for 5-in. belt, and transmits motion to the spindles through tangent gearing, securing great power with extreme steadiness under cut, and rendering the machine practically noiseless in action.

The countershaft pulleys are 23 in. in diameter, for a belt 5 in. wide, and should run 100 revolutions a minute. When operating on a diameter of 7 in. this gives a cutting speed of 20 ft. a minute.

A machine of this sort has just been sent to the Grant Locomotive Works, Chicago.

Train Accidents in the United States in the Month of May.**COLLISIONS.****REAR.**

1st, on New York Central & Hudson River, at Churchville, N. Y., a westbound freight, standing at the station, was run into by a following freight, which was running at high speed. The wreck obstructed the adjoining freight track, and an eastbound freight train ran into it, 2 engines and 13 cars being demolished. The wreck took fire by the explosion of an oil car, and a large portion of it was burned up. The engineer of the eastbound freight was killed and the fireman injured.

1st, on Chicago & Eastern Illinois, at Cayuga, Ind., a freight train, which was coming to a stop at a water-tank, with a portion of the cars standing on a bridge 175 ft. long, was wrecked by the failure of the bridge, 13 cars going down into the river. It is supposed that the train had broken in two, and that the foremost portion having stopped, the rear part ran into it, forcing a light platform car to one side sufficiently to break the bridge truss.

1st, night, on Illinois Central near Holly Springs, Miss., north bound passenger train No. 4 ran against some rails that had been piled maliciously upon the track, damaging the engine and slightly injuring some of the passengers. While the train was waiting for the track to be cleared it was run into at the rear by a following freight train, wrecking a sleeping car, which at once took fire

rear of another gravel train standing on the side track, injuring an engineer and brakeman.

24th, 11 p. m., on New York, Lake Erie & Western at West Tuxedo, N. Y., an east bound freight train which had stopped a short distance east of the signal tower was run into at the rear by a following freight which approached the tower too rapidly. A car of lumber was shaken by the shock, so that a portion of the load fell upon the adjoining track, in front of a west bound freight train, which was derailed, the engine and several cars going down a bank. The fireman was killed and 1 brakeman was injured. The wreck took fire and 13 cars were burned up.

25th, on Fitchburg road at Orange, Mass., a passenger train ran over a misplaced switch and into a freight car standing on the side track, doing slight damage. The fireman was injured by jumping.

27th, on Pittsburgh & Western at Niles, O., a heavy freight train ran over a misplaced switch and into some cars standing on a side track, making a bad wreck and throwing 5 cars down a high embankment. Two men were killed and 2 trainmen injured.

27th, 10 p. m., on San Antonio & Aransas Pass, at Eagle Lake, Tex., a passenger train ran into a car of lumber which had been left standing on the main track, making a bad wreck and injuring the fireman and 3 passengers.

And 15 others, on 12 roads, involving 5 passenger and 23 freight and other trains.

BUTTING.

3d, on Illinois Central at Mendota, Ill., a passenger train ran over a misplaced switch and into the head of a freight train standing on the side track, killing the passenger engineer and injuring 3 other trainmen.

4th, on Pittsburgh, Cincinnati, Chicago & St. Louis at Scio, O., butting collision between the second section of east bound passenger train No. 2, and a west bound freight train. The passenger train was running at high speed and the wreck was a bad one. One engineer, 6 passengers and 2 tramps injured. The men on the freight train disregarded the green signals carried by the first section of the passenger train.

6th, on Union Pacific near Chisaca, Col., butting collision between freight trains, one of which was running backward, wrecking the caboose and killing an employe riding in it.

11th, on Colorado Midland, near Manitou, Col., butting collision between a passenger and a freight train in a tunnel, the freight engineer being slightly injured.

14th, on New York, Ontario & Western, near Fish's

to the train by land. It is said that the conductor of the passenger train disregarded his telegraphic meeting orders.

20th, on Chicago, Milwaukee & St. Paul, at Preston, Ia., a freight train running at high speed ran over a misplaced switch, and into the head of a work train standing on the side track, making a very bad wreck, and causing the explosion of the boilers of both locomotives. Fifteen cars were wrecked and the station building badly damaged. One engineer was killed, and 2 other trainmen injured.

20th, on Houston & Texas Central, near Elgin, Tex., collision between an empty engine running west and a freight train running east, making a bad wreck and causing the death of one of the engineers. A brakeman was injured. It is said that the engineer who was killed had disregarded an order to meet at McDade.

21st, a. m., on St. Louis, Vandalia & Terre Haute, near Greenville, Ill., butting collision between an empty engine east bound and passenger train No. 17 west bound, both engines and a baggage car being wrecked, and an express messenger killed. Four trainmen were injured. The locomotive belonged to the Jacksonville Southwestern road and was being run over the Vandalia line in consequence of the floods. It was in charge of a pilot who forgot about the passenger train. The coroner's jury found that the pilot was suffering from loss of sleep and therefore "not guilty of criminal negligence."

28th, 4 a. m., on Pittsburgh, Cincinnati, Chicago & St. Louis, near Howlands, Ind., butting collision between a freight and a passenger train. Both trains had been slackened somewhat, but were running 10 or 15 miles an hour when they struck each other. The wreck was a very bad one, but the passenger cars were not badly damaged. The fireman was fatally injured, and 3 trainmen and 3 passengers badly hurt.

And 3 others, on 3 roads, 4 passenger and 2 other trains.

CROSSING AND MISCELLANEOUS.

4th, on Kansas City, Memphis & Birmingham, at Carbon Hill, Ala., a passenger train ran into a coal car which had run out of a side track, damaging the engine. The engineer was injured by jumping.

12th, on Cleveland, Cincinnati, Chicago & St. Louis, near Lindale, O. A freight train moving backward on a side track ran over a misplaced switch and struck a passenger train, damaging several cars and derailing one of them. One passenger and a fireman were injured.

23d, on New York Central & Hudson River near Clinton Point, N. Y., an inspection engine running as the

second section of passenger train No. 20 ran into a yard engine, doing considerable damage and injuring 5 employees riding on the engine. It appears that the runner of the yard engine had failed to observe the green signals on the first section of No. 20.

27th, on Chicago, Milwaukee & St. Paul, at Western Union Junction, Wis., collision between freight trains, causing the death of two men, who, from the reports, seem to have been trespassers.

31st, at the crossing of the Cleveland, Lorain & Wheeling and Cleveland & Pittsburg, at Bellaire, O., collision of freight trains, damaging both engines and wrecking 4 freight cars. A brakeman was injured. Each train claims to have had a clear signal to pass the crossing.

And 12 others on 12 roads, involving 2 passenger and 21 freight and other trains.

DERAILMENTS.

DEFECTS OF ROAD.

2d, 1 a. m., on Louisville, New Albany & Chicago, near Otis, Ind., a freight train broke through a trestle bridge, 8 cars going down in a very bad wreck. Engineer, fireman and one brakeman killed. A dam a short distance up stream had given way in consequence of heavy rains, and a flood had carried a saw-mill down against the bridge.

5th, 2 a. m., on Atchison, Topeka & Santa Fé, near Revere, Mo., an east-bound passenger train in crossing a trestle which had been weakened by a flood, was overturned, the whole train except the engine and rear car going into the water. Six passengers and a brakeman were killed, the reports indicating that all of them were drowned. Five trainmen and 25 passengers were injured.

6th, on Memphis & Charleston, at Florence, Ala., the engine and 5 cars of a freight train broke through the bridge over the Tennessee River and fell into the stream. The accounts indicate that one span of the bridge and a portion of the trestle approach were destroyed; one brakeman was badly hurt and the engineer and fireman slightly injured. This bridge has been weak for a long time, and has been the subject of investigation by the Alabama Railroad Commissioners.

6th, on Burlington & Missouri River, near Crete, Neb., an eastbound passenger train was derailed at a culvert which had been weakened by heavy rains, and the engine and 2 cars were thrown into the ditch. The fireman and 2 tramps were killed; 7 other trainmen were injured.

17th, 3 a. m., on Central Branch Union Pacific, near Concordia, Kan., a circus train was derailed by the failure of a small culvert and several cars were piled up in the stream, 20 animals being drowned. The culvert had been weakened by heavy rains. Four circus men were killed and 5 injured. It appears from the testimony before a coroner that the unsafe condition of the track was discovered by a section master, who, instead of leaving a danger signal at the spot, went on to the next station and telegraphed back. His telegram came five minutes after the train had started.

19th, on Pennsylvania road, at Norristown, Pa., the engine of a freight train was derailed by a defective switch on a bridge, and fell into the street below. Engineer and fireman badly injured.

31st, on Chicago & Eastern Illinois, near Danville, Ill., a mixed train was derailed at a point where the track had been weakened by rain, and several cars were overturned. Six passengers injured.

31st, on Adirondack & St. Lawrence, near Moose River, N. Y., the engine of a freight train was derailed and overturned at a point where the roadbed was not firm enough, and the engineer was killed.

And 6 others on 5 roads, involving 4 passenger and 2 other trains.

DEFECTS OF EQUIPMENT.

2nd, night, on Ohio River Road, near Murfreesville, W. Va., a car in a freight train was derailed by a broken flange; the train ran up a long trestle and 13 cars, most of them loaded with rails, broke through. The brakeman who went back to flag following trains fell asleep and was run over by the wrecking train.

7th, on Pennsylvania near Phillipsburg, N. J., passenger train derailed by a broken wheel. A passenger who jumped off fell under the train and was killed.

12th, on New York & New England near Danbury, Conn., 9 cars of a freight train derailed and wrecked by the breaking of a drawbar which fell upon the track. Both this road and the Housatonic, which lies alongside of it, were blocked 6 hours.

14th, on Gulf, Colorado & Santa Fe near Crawford, Tex., the caboose and 7 cars of freight train were derailed by a broken truck, making a bad wreck. Conductor and one brakeman injured.

And 7 others, on 9 roads, involving 1 passenger and 12 freight and other trains.

NEGLIGENCE IN OPERATING.

12th, on East Tennessee, Virginia & Georgia, near Silver Creek, Ga., 2 cars of a passenger train were derailed and overturned, 3 passengers, conductor and porter being injured. It is said that the train was running rapidly on poor track.

16th, on Missouri Pacific, near Fort Gibson, I. T., a freight train was derailed by a misplaced switch, one brakeman being killed.

24th, on Richmond & Danville, near Bryson City, N. C., a freight train became uncontrollable on a steep grade and ran so fast that it jumped the track, the engine being overturned and the engineer killed. The fireman was injured.

31st, 3 a. m., on Deadwood Central, near Pluma, S. D., a passenger or mixed train became uncontrollable on a steep grade, and ran at high speed some distance to a curve, where it was derailed, killing a man riding on the engine and injuring 5 passengers.

And 5 others on 5 roads, involving 1 passenger and 4 freight and other trains.

UNFORESEEN OBSTRUCTIONS.

2d, on Wabash road, near Crown Point, Ind., a west-bound passenger train was derailed by a washout, one sleeping car being overturned and thrown down a bank. Several passengers were seriously injured.

7th, on Birmingham Mineral, near Compton Mines, Ala., a freight train ran over a cow, and the engine and 4 cars were derailed, one trainman being killed and another badly injured.

8th, on New York, Lake Erie & Western, near Carrollton, N. Y., a freight train ran over a cow which had fallen into a cattle guard, and the engine and 3 cars were derailed and ditched. Engineer, fireman and one brakeman injured.

10th, 10 p. m., on Norfolk & Western, near Dickson, W. Va., a gravel train was derailed by a landslide. The conductor was fatally and the fireman less severely injured.

17th, on St. Paul & Duluth, at Carlton, Minn., a gravel train running backward at considerable speed ran into a

herd of cattle, derailing and wrecking 6 cars. One employee was killed and 20 injured.

19th, on Baltimore & Ohio, at Lemont, Pa., a freight train ran over a horse on a high trestle, wrecking 10 cars, which fell 50 ft. to the ground below. A man riding on the cars was killed, and 2 tramps injured.

27th, on Berkiomen railroad, near Green Lane, Pa., a train consisting of one freight and 4 passenger cars, pushed by a locomotive at the rear, was derailed by a landslide. A brakeman riding on the freight car, which was foremost, was slightly injured.

28th, on Texas & Pacific, near Moore Springs, Tex., a freight train was derailed at a washout, wrecking 8 cars and derailing many more. Over 200 head of cattle were killed. Two tramps riding on the trucks were fatally injured, and 2 trainmen badly hurt.

29th, night, on Atchison, Topeka & Santa Fé, near Lemont, Ill., a northbound passenger train was derailed by a cow which had fallen into a cattle guard, the engine and tender being thrown into a river. The first two cars were badly wrecked and the sleeping car thrown into the river. The engineer was killed and 11 passenger were injured.

31st, 3 a. m., on Lake Erie & Western near Fishers, Ind., a passenger train was derailed by a washout, damaging several cars, some of them being overturned. Engineer and one passenger badly injured.

31st, on St. Paul & Duluth near Sturgeon Lake, Minn., freight train No. 18 was derailed by a pair of oxen which were on the track, 17 cars being ditched. The fireman was killed, and two other trainmen badly injured.

And 3 others on 3 roads, involving 0 passenger and 3 freight and other trains.

UNEXPLAINED.

8th, on Baltimore & Ohio, near Sykesville, Md., a freight train was derailed and 2 cars were wrecked. They were loaded with alcohol, lard and live hogs, and a fire breaking out, a large portion of the wreck was burned up. The fireman and one tramp were injured.

14th, on Norfolk & Western, near Grimes, Md., a passenger train was derailed and the conductor killed. Five passengers were injured.

26th, on Union Pacific, near Gilmore, Neb., the mail car of passenger train No. 8 was derailed while the train was running at high speed and the tender and 2 cars were badly damaged. Three trainmen injured.

And 18 others, on 17 roads, involving 3 passenger and 15 freight and other trains.

OTHER ACCIDENTS.

4th, on Pennsylvania & Northwestern, at Irvona, Pa., the locomotive of a freight train was wrecked by the explosion of its boiler, the engineer and fireman being killed.

12th, on Hoosac Tunnel & Wilmington, near Hoosac Tunnel, Mass., a passenger train ran into a large rock which had rolled upon the track and the boiler of the locomotive exploded. The engineer and fireman were badly and several passengers slightly injured.

16th, on Burlington & Missouri River near New Castle, Wyo., the locomotive of a freight train was wrecked by the explosion of its boiler. The engineer and fireman were killed and a brakeman badly injured.

16th, on Central of New Jersey, near Cranford, N. J., the locomotive of a fast express train was badly damaged by the breaking of a connecting rod. The fireman was badly scalded. The engineer was also scalded somewhat, but at once jumped off into a mud pond, which probably saved his life.

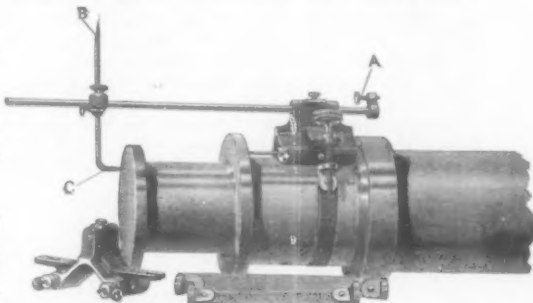
25th, on Michigan Central, near Roscommon, Mich., the caboose of a freight train was wrecked by a log, one end of which fell off the car in front of the caboose. A

brace, the rail is prevented from canting, and the strain on the spike on the inside of the rail is removed.

It is said that about 2,000,000 of these braces are in use, and they are used by such roads as the Rock Island, Northwestern, Santa Fe, Northern Pacific, Illinois Central, Pennsylvania Co., Louisville & Nashville, Union Pacific, Baltimore & Ohio, Boston & Maine and others.

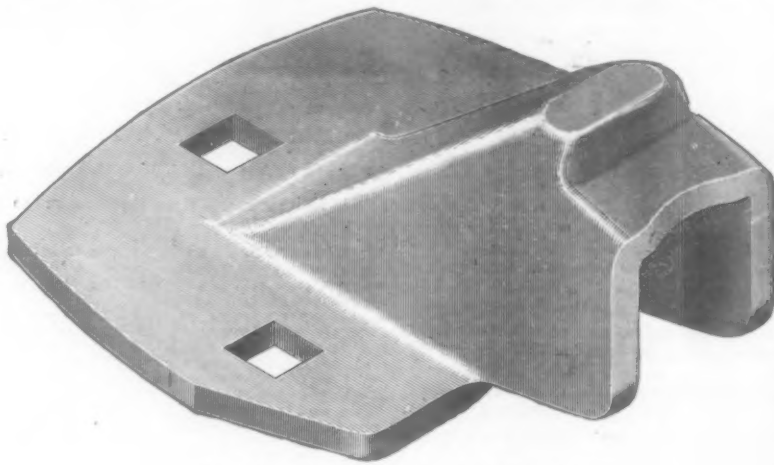
The Standard Crank Pin Gauge.

Crank pins will become bent and wear eccentrically and unevenly in spite of the best care that can be given to them. When bent or unevenly worn they must be trued up by turning or grinding, and it is cheaper, and for several reasons better, to true them up without taking them out of the wheels. It is not a simple matter



to determine whether a crank pin is slightly bent or not. Of course bending causes heating, and a hot crank pin generally gives rise to a suspicion that the pin is bent a little. To determine whether a pin is straight, and if it has worn on all sides alike, the gauge shown in the cut has been devised.

It is used as follows: Mount the gauge on the crank pin as shown in cut, set up the testing screw A until it touches the face of the crank pin hub. Then revolve the gauge around the journal of the crank pin, and watch the point of the testing screw; if it touches the face of the pin hub all around, the pin is at right angles. If it is off at one place on face of hub and touches it at another the pin is bent. To determine if the journal of the crank pin is round, and true with the centre of the crank pin, mount the gauge as shown in the cut, excepting adjust the straight point of needle B to the rim of the outer collar of the crank pin until it touches the surface of the collar. Then revolve the gauge around on the crank pin, watching the point of the needle; if it touches the surface of the collar, all around the journal is round and true with the centre of the crank pin, but if the needle touches the surface in places and shows open in other places the journal is eccentric. To meas-



Steel Rail Brace of the Weir Frog Company.

brakeman was killed and the conductor and 2 brakemen injured.

And 3 others, on 3 roads, involving 2 passenger trains and 1 other.

A summary will be found in another column.

The Weir Frog Company's Steel Rail Brace.

This brace is made in three designs which differ only in style of base. The No. 1 has all the spike holes cut inwardly from the edge; the No. 3 has the spike holes on the side protected by metal, while the hole in the shank is unprotected; the No. 5, which is the design here shown, has all the spike holes protected. They are made of homogeneous steel plate $\frac{1}{4}$ in. or $\frac{3}{8}$ in. thick as preferred and so formed as to have parallel vertical sides. These vertical sides are bridged across under the head of the rail to strengthen them at the point where it engages the under and outer sides of the head of the rail. The vertical sides and shape generally make a more rigid and a stronger brace with a given thickness of material than any other brace, and being of the box form, it fits over the one spike in the tie, and then being secured with three spikes makes a very rigid support.

By bracing the rail under the head as is done with this

ure the eccentricity, describe a concentric circle on the end of the pin, mount the gauge on the crank pin, as shown in the cut, set the bent end C of the needle B on the circle and revolve the gauge around on the journal of the crank pin; the amount of eccentricity of the journal of the pin will be described on the outer end of the crank pin. This device is manufactured by M. C. Hammett, Troy, N. Y.

Indian Railroad Notes.

Accidents.—The butting collision between the mail train and a freight train, on the Rajputana-Malwa Railway, to which I alluded in my last, was caused by defective management. Two train dispatchers were on duty at the same time, and after one of them had started the freight train the other, a native clerk, issued a "line clear ticket," authorizing the mail train to run in the opposite direction on the same track. The case was taken up by the police, but the magistrate who tried it was of opinion that the system was more in fault than the individual, and imposed a fine of 50 rupees only.

Two cases of car axles breaking have occurred since I wrote last. In the first case the leading axle of a loaded wagon, belonging to the East Indian Railway, which

uses iron axles only, broke while traveling over the Indian Midland Railway and the wagon was dragged a considerable distance before the accident was discovered. The rails remained intact, but the tie-fastenings were damaged considerably. The second case occurred on the Madras Railway, and eight vehicles were derailed and badly damaged before the engineer could stop the train.

Several derailments have occurred, owing, it is said, to the exceptionally hot weather which has been experienced up country; but, fortunately, no serious damage has been done, although in several cases the derailed trains were conveying passengers. The sudden rise in temperature which occurs during the latter part of March and beginning of April causes the rails to buckle badly, if the splice bolts are too highly screwed up; especially if the track is insufficiently ballasted.

At the commencement of the hot season every one who can contrive to leave Calcutta for a time is anxious to get away as soon as possible, and the result has hitherto been that passengers have been incommoded and trains could not run to schedule time. Thanks to the foresight of the new Traffic Manager of the E. I. Ry., an extra fast train for passengers proceeding to Europe via Bombay was run daily during the busiest time, and those who were en route for the Himalayas had a train

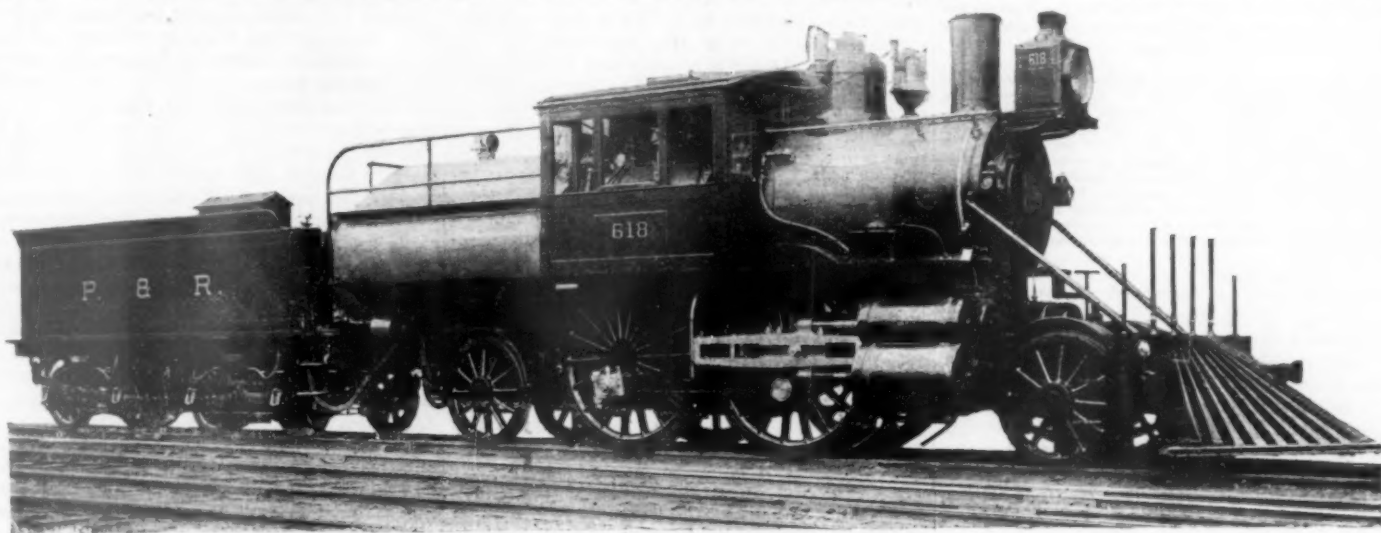
area of new coal fields will ere long be in direct communication with Calcutta. Most of the coal mining companies are extra busy, but only a few succeed in paying good dividends. Indifferent management is no doubt the cause, and a change in the supervising staff does not always mean an improvement in the working. Now that the rates for the carriage of coal have been reduced, no other fuel would stand a chance of being used to any great extent if the coal-producing concerns were sensibly managed.

Car Lighting, Etc.—The Bombay, Baroda & Central India Railway has been the first to introduce an improved system of lighting railroad carriages in India. For some time past experiments have been made with Pintsch oil gas, and the train which has been fitted up with this system presents such a marked contrast to the old castor-oil lamp, that other companies cannot afford to retain the old style of lighting any longer. The castor oil industry has also been seriously interfered with by the introduction of Canadian mineral oil as a lubricant for locomotives and cars. On some lines the cost per train mile has been the same with both lubricants, but on others the mineral oil has been proved to be much the cheapest.

Iron and Steel.—The Price of Silver.—The Barakur Iron & Steel Co. has booked an order for 1,000 tons of

return parallel rod, the leading and trailing trucks, the Wootten boiler, with an enormous heating and grate surface, Vaucain compound cylinders and high boiler pressure. The following data are from the specifications of the engine:

Weight in working order.....	129,000 lbs.
On drivers.....	85,000 lbs.
Cylinders, Vaucain compound.....	13 in. and 32 in. x 24 in.
Drivers.....	78 in. diam., 72 in. centres.
Fuel.....	hard coal.
Wheel base.....	total, 23 ft. 4 in.
" driving.....	6 ft. 10 in.
" engine and tender.....	50 ft.
Boiler, 7 in. x 1 in., Wellman homogeneous steel.....	57½ in. diam.
Tubes.....	321, No. 13 W. G., 1½ in. diam., 10 ft. long.
Heating surface, combustion chamber.....	45,375 sq. ft.
" " tubes.....	1,261.75 "
" " firebox.....	128.00 "
Total heating surface.....	1,435.215 sq. ft.
Firebox.....	114 in. x 90½ in.
Water space.....	3½ in.
Grates.....	water tubes and cast iron bars.
Smokebox with netting set vertically 6 in. from tube sheet.	
Engine truck—Centre bearing, swiveling, with radius bar,	
2 wheels, 48 in. diam., with steel tires, cast iron centres.	
Journals, 6½ in. x 10 in.; Ajax brasses.	
Engines have Detroit triple cup sight feed lubricators; U. S.	
metallic packing for piston rods and valve stems; cross-	
heads of Europa cast steel lined with tin; standard tires; two	
No. 9½ Sellers' 1887 injectors; stub brasses of Ajax metal;	
sand boxes below running boards; three Ashcroft muffled	
safety valves; Westinghouse American outside equalized air	



FAST WOOTTEN COMPOUND ON THE PHILADELPHIA & READING.

to themselves. The traffic is extra heavy at present on most railroads, and there is every prospect of it continuing, although on some lines the drying up of wells and reservoirs is causing great anxiety. In many parts of the country no rain has fallen since September, 1891, and the regular rains are not due until the 15th June.

New Projects.—A new survey for the Kalka-Simla Railway has been ordered. The Nilgiri Mountain Railroad is progressing apace, but as fifteen years have elapsed since the project was first mooted, very few of the original promoters will derive any benefit from it. The ruling gradient on the Ghat is 1 in 12½, and the minimum radius of curvature 328 ft.; but it has not been definitely decided what system of working will be adopted. The Riggensbach rack rail was proposed so far back as 1880, but since then this method of working has been tried on the Frontier Railroad and condemned as unsuitable.

The Kidderpore docks are now fairly open, but some of the traders still stand aloof. The docks should certainly facilitate the shipping of grain and coal to an important extent.

Preparations for war are still being made on the Frontier railroad, and nine miles of sidings for troop trains have recently been completed at Peshawur. New steel girders for the bridges over the Jhelum and Ravi rivers have arrived, and when they are in position trains will be able to cross at full speed, instead of slowing down to five miles an hour, as they have done for some time past. The old bridges were ordered when the line was being laid to metre gauge, and when it was widened to 5 ft. 6 in., the speed and weight of the rolling stock taxed them heavily. When two locomotives were attached to the same train, it was thought necessary to place at least three empty cars between them, in order that the two engines should not be on the same span at the one time.

The Chittagong-Assam Railway scheme has at length been successfully floated, and there is hope of it progressing apace. Including branches there will be 742 miles of track, and the capital required is six millions sterling, of which the projectors provide 1½ millions and the government the balance. The line will be completed in seven years, and at the end of thirty years the state is entitled to buy up the whole concern at par.

Several short branches and feeder lines have been commenced as famine relief works in districts where scarcity exists, but work will probably be stopped directly the villagers are able to obtain food elsewhere.

The Therriah branch of the E. I. R., starting from Barakur, is being pushed on vigorously, and, as the Engineer-in-Chief is an exceptionally energetic officer, a large

pig-iron from the E. I. Ry., for making cast iron ties, but none of the other railroad companies appear to be doing anything toward manufacturing metal ties, fish-plates, etc., although the present low rate of silver raised the cost of all imported supplies considerably. Importers have raised the prices of imported goods twice during the last few months and Anglo-Indians in addition to the loss by exchange on home remittances have now to pay ten per cent. more for stores than they were paying a year ago. All the leading companies have to pay their dividends in sterling, and this is becoming a serious matter, as most of the shareholders are living in Europe and the loss by exchange means a much smaller return than would otherwise be forthcoming.

The government have engaged an experienced steel maker, who is now busily engaged in erecting a Siemens furnace at Cossipore (one of the suburbs of Calcutta). We have plenty of raw material, iron ore, limestone and coal, and in a few years time might easily be independent of supplies from Europe, if the government would take the matter up in earnest. If, as some contend, a low rate of exchange benefits Indian trade, we certainly ought to beat the record this year. The rupee, although nominally worth two shillings, is taken at one shilling and threepence, when converted into sterling, and a bill of exchange on Europe for £10, now costs Rs. 100, instead of Rs. 100, as some people imagine.

The Northwestern Railway headed the list of railroad earnings last year, and the government have sanctioned the payment of a bonus of one-half per cent. of the net earnings to the non-pensionable employees. This extra grant, added to the fixed bonus, will nearly double the amount contributed to the Provident Fund of each individual, during the past year. On the E. I. R. the results are even better than this, but the papers have not been issued yet. The principle of allowing all classes of railroad employees to participate in the profits has worked well in India, and is an example which might be followed with advantage in other countries.

CALCUTTA, April 24, 1892.

NUTLOCK.

Fast Wootten Compound on the Philadelphia & Reading.

In the *Railroad Gazette* of Nov. 13, 1891, there were given an outline drawing and some dimensions of the Philadelphia & Reading Wootten compound passenger locomotive. The design is so novel and the action in service has been so satisfactory that further illustration will be of interest. The cut from a photograph shows perhaps better than the outline cut given before the special feature of the engines, which are, in general; The

brakes for drivers and tender, and Westinghouse train signals. The tender has an 8-in. channel iron frame and is fitted with a water scoop and Miller buffer.

Orders for several duplicates of this engine have been placed with the Baldwin Locomotive Works.

Railroad Building in Russia.

A brief account of the various Russian railroad projects on which work was begun last year is given in the *Industrie-Zeitung* of Riga. The roads are divided into those under construction by the government and those in private hands. Among the former there is given, first, the Dshankoj-Feodosia road, Feodosia, the end station being on the Black Sea. It was commenced in the spring of 1891 and will have a length of about 110 versts (about 73 miles). Its estimated cost is 2,952,821 roubles (about \$1,500,000). Second in order is the Ussur-road, which constitutes the last division of the Pacific coast portion of the Siberian railroad. This division may be considered as made up of two parts, one reaching from Vladivostok to Gafskaja on the Ussuri River, and the other from Gafskaja to Chabarowka. Surveys for the latter of these two sections have not yet been made. The length of the former will be 303 versts (291 miles) and will cost 18,500,000 roubles or about \$9,250,000.

The third road is the Miass-Tscheljabinsk section of the Siberian line. This road, 94 versts (about 62 miles) long, will be the connecting link between the Siberian and the European Russian railroad system, and will cost 3,624,005 roubles (\$1,312,000). It will be ready for traffic, it is thought, early next year. The fourth road will be an extension of the Ssakssagan branch of the Jekaterinen road to the Kriworog ore regions, and will help materially to develop that district. Its length is given as 16.7 versts (about 11 miles), and its cost to the government will be about 540,000 roubles (\$270,000).

The Sarew road, the fifth in the list, will be 134 verst, (about 88 miles) long, will cost about 6,000,000 roubles (\$3,000,000), and is designed to serve local freight interests. Finally, there is to be a road from Tschiaty to connect with the Trans-Caucasian line, covering a distance of 34 versts (about 23 miles) with an estimated cost of 1,000,000 roubles (\$500,000).

The roads under private control will be: (1) the Rjasan-Kasan line to connect the town Rjasan with the Russian main lines; (2) the Petrowsk line, the terminal station of which will be the town of Petrowsk on the Caspian Sea; and (3) a number of branches to the Kursk-Kiew Railroad. The total length of all these roads is placed at 1,236 versts (about 853 miles), and the combined estimated cost will figure up 45,100,000 roubles, or about \$22,600,000.



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EDITORIAL ANNOUNCEMENTS.

Contributions.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.

Advertisements.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. We give in our editorial columns OUR OWN opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.

The latest phase of Richmond Terminal affairs is interesting. Messrs. Drexel, Morgan & Co. decline to undertake a reorganization except under conditions that seem impossible. Their letter appears in our column of general railroad news. So, as matters now stand, the Richmond Terminal Co., the Richmond & Danville, and the East Tennessee, Virginia & Georgia are all in the hands of receivers, and the security holders are under the protection of the courts. To them, the creditors, the situation may not be satisfactory, but it is comfortable for the time. They can now wait for reorganization with some security, and if the result is the disruption of the Richmond Terminal, they will probably not lose much. Indeed, it now looks very much as if the outcome would be the breaking up of that gigantic and apparently useless scheme and the reversion of the control of the properties to two or three corporations. There seems to be no sufficient economical reason for the effort to consolidate them; to the people of the states and communities in which the properties lie, and to most railroad men who are interested in them there have always seemed to be great reasons against the consolidation.

On another page will be found a summary of the very valuable report of the Committee on Compound Locomotives of the Master Mechanics' Association. We expect to publish soon a detailed analysis of the results obtained in the tests made by the committee. In the meantime, the general results which are of immediate practical value may be summarized from the tables published last week as follows: With Braceville coal, 17 trips of the single-expansion engine, with 180 lbs. pressure, compared with seven trips of the compound, with the same pressure, show a saving by the compound of 12.9 per cent. in coal per horse power hour and 7.0 per cent. in water per horse power hour; The same 17 trips of the single-expansion engine compared with 12 trips of the compound with 200 lbs. pressure show savings of 20.5 and 20.8 per cent. in coal and water respectively. As illustrating the difficulty of analyzing such tests as these and also showing the practical flexibility of the compound, it may be noted that the most economical trips, on the basis of the foot-tons of work done per pound of coal are, in order:

1. Light train, easy run, high speed.
 2. Heavy train, large number of cars, favorable conditions.
 3. Average train, good run.
 4. Heavy train, few stops, short time at stations, rear wind, bad rail.
 5. Heavy train, slow speed, average number of stops.
- The performance, if based upon foot-tons per pound of water, or upon water and coal per horse power hour, agrees very closely with the above.

Col. H. S. Haines, President of the American Railway Association, has in the *North American Review* for July, an article on "Railroad Safety Appliances."

It is a condensation of his address of last April, which was reported in the *Railroad Gazette*, of April 15 and April 22, and therefore contains no news for our readers; but it is a good thing that Colonel Haines has placed this authoritative statement of facts before the magazine-reading public, for Prof. H. C. Adams' article in the June *Forum* conveyed some erroneous impressions which may do a good deal of harm. As Professor Adams is the official statistician of the government, his paper is likely to be received with respect and confidence, but his figures are mostly useless and most of his conclusions erroneous, though his final summing up consists of general statements which are more consonant with the results of experience and not without value. Professor Adams gives the statistics of June, 1890, now good for nothing, and adds no hint that they are not the latest and best obtainable; and, ignoring the general progress (universal progress, we may say, east of the Missouri River) toward making the Master Car Builders' standard freight car coupler the common type, he says that Government intervention is needed not so much to coerce reluctant companies as to arbitrate between the advocates of various patents! Professor Adams attributes the alleged increase of danger to trainmen by the use of safety appliances to the fact that there are 44 kinds of couplers and nine kinds of brakes; while every railroad man knows that 42 of the so-called "kinds" of couplers really cut no figure in the matter at all; and the increase of casualties, if there is any, is amply accounted for by the existence of two kinds, the link-and-pin and the M. C. B. standard. One paragraph in Colonel Haines' article (which did not appear in the April address contains the following conundrum for the lawmakers: "A penal statute concerning technical matters should carry with the penalty to those who disregard its provisions some protection to those who obey them. Are the advocates of penal legislation prepared to relieve railroad corporations from responsibility for damages to those injured while using the devices prescribed by such legislation? A statute defective in this respect might be sustained in the courts, but it would be none the less in justice under the guise of law."

An interesting review of the present status in Europe of what we may term the color-blind agitation will be found in another column, condensed from a report issued by the British Medical Association. We do not use the term "agitation" in any deprecatory sense, for the doctors who started it are sincere in their aims and cannot, on the whole, be regarded as unpractical in their methods; but in view of the exceeding rarity of anything like disastrous results from a lack of perfect color sense in a railroad man, and the consequent looseness with which railroads carry out their plans for weeding out unsafe men, it can hardly be said that the advocates of strict and scientific care over this feature of railroad operation have yet done more than stir up the matter. Serious, systematic and scientific attention is given to it on only a few roads. Of those few the United States probably can show its full share, though the British report gives no information from this country except that concerning the Alabama law, which, though it has been set before the English doctors as an important affair, can hardly be said to deserve such distinction, for the reason that Alabama railroads are unimportant as compared with those of the whole country. The English roads, like many here, apparently govern themselves largely by "expediency;" that is, the prejudices of the employees. The officers probably see the need of strict tests, but when resistance to them is threatened by an engineers' brotherhood, whose members are scared out of their wits at the prospect of losing their jobs because they guess at signals, inconclusive, or even misleading, tests are substituted for those known to be just and necessary. Justice is neglected on the ground that refractory employees practically compel that course to be taken; and, as for the necessity, the manager flatters himself that it is not so pressing as the doctors would make it out. This has been the case in America and this pamphlet is not lacking in evidence that the same conditions exist in England. We have said that the doctors are not unpractical; but yet we are not sure that their course is just right. The tone of this report, like the tone of Dr. Jeffries' public utterances in this country, is such as to lead unfriendly critics to assert that the doctors are simply trying to get jobs for themselves; are magnifying their own office. We do not take this view, but as long as a surgeon of established reputation recognizes (by using) a system in which all but special cases are settled by non-medical examiners, as is the case on the Pennsylvania road, it is no wonder that the persistent claim that only a specialist is a safe examiner is received with some in-

credulity. The doctors' persistence in this direction doubtless tends to make many old fogies among railroad officers all the more persistent in using empirical methods.

Railroad Building in 1892.

The steady decline in railroad building which has been going on for five years not only continues, but is greater this year than it has been in any other one of the five years. The data published on another page show that in the first half of this year there have been built 1,198 miles of new railroad in the United States. This is 500 miles less than was built in the first half of 1891, and considerably less than the mileage built in the first half of any year back to 1885.

Not only has the construction of new road fallen off, but there is no indication now that it will pick up again this year. On the contrary, the indications are decidedly against any improvement. When our detailed table is published next week, it will be seen that most of the building this year is in finishing work already begun, and that there is wonderfully little new work projected or "under contract or survey."

Generally the new construction in the first half of the calendar year is considerably less than in the second half. This would naturally be so because (if for no other reason) the months of January, February and March are the worst in the year for railroad building. In the three years, 1888-1890, 34.2 per cent. of the total railroad building of the year was in the first half. This was the average of the three years. In 1891 that built in the first half was 40 per cent. of the whole. Probably the history of 1892 will not be better than that of 1891, and in fact we judge that it will be worse. If, then, 40 per cent. of the year's mileage has been built up to July 1, the total will not be more than 3,000 miles. Of course we do not give this figure as anything better than a guess; and, in fact, we shall be rather surprised if the total is not even less. The total mileage built in 1885 was less than 3,000, and to find another year that fell below 3,000 miles we must go back to 1878, when the net increase (by Poor) was 2,679 miles.

It is apparent that it will not do to base one's hopes of better times on the money to be spent in building new railroads; but the influence of this element on the sum of the business and industrial situation is considerably overrated. The difference between 13,000 miles and 3,000 miles of new railroad built in a year (that is, between 1887 and 1892) is, no doubt, enough in itself to affect general business. It is a difference of, say, 1,000,000 tons of rails—more than half of our total product in 1890 and two-thirds of that of 1891. It is a difference of, say, 1,500,000 tons of iron for joints, bolts and spikes. But all of the rails made in the United States only consume about one-fifth of the pig iron made and less than half the steel ingots produced, and the figures given above are based upon a comparison with a phenomenal year, 1887, when about 13,000 miles were built. In only one other year in our railroad history did the new construction reach 10,000 miles. If, then, we compare the first half of 1892 with the first half of 1891, when we find the falling off in railroad building to have been 500 miles, we shall see that it affects but an insignificant percentage of our total iron and steel production. Similarly, it might be shown that the effect of the decline upon the locomotive and car shops, and upon the general railroad supply business, is, after all, relatively very small. The fact is, the business of building railroads has ceased to be a great factor in any one year's prosperity. To a few people it is of immense importance, but to the nation it is a small affair, and we must look elsewhere for the causes of any business depression. The falling off in new construction is only a symptom and not a cause.

The changes in the geographical distribution of the new railroad may be best shown in a table of percentages. The groups are those that we have used in former years, viz.: Southern States east of the Mississippi, Northern States east of the Mississippi, Southwestern States, Northwestern States and Pacific Coast States. The percentages of the whole building which has been done in these groups are:

	1890.	1891.	Half of 1892.
Southeastern	36	31	27.4
Northeastern	24	18	23.3
Northwestern	10	21	19.4
Southwestern	18	18	11.9
Pacific	12	9	8.

The decline in the percentages of the southern states is noticeable, but is what has been expected by all who have watched the course of events there. It will be seen that Texas has built 53 miles in spite of the hostility of the state government to the railroads, and that there are but nine states that have built more; but of this 53 miles 42 were under way before this administration came into power. For the present railroad enterprise in that State is as dead as it is in Iowa.

The Harrisburg Collision.

Twelve passengers have been killed in a collision which was at least partially due to what the English inspectors call a "failure of block working," and the public may possibly surprise our two great rival railroads one of these days by reversing the order of its opinion of their respective methods. In discussing the late disaster on the New York Central, people and press have pointed to the Pennsylvania, and justly, as an example to be followed by the Central. The fact that the Pennsylvania has the most extensive block system in the country seems to have finally found a lodgment in the public mind and the company has reaped the advantage of it. The passenger agent has lately amplified his advertisements by the insertion of a paragraph about blocking and interlocking, and the strength of such a statement, compared with the more poetical but less assuring announcements of the New York Central, has been pointed out by sharp critics to the disadvantage of the latter. But the Central has taken the advice that was given, and is now equipping its line with safety devices; and in following the Pennsylvania people it has "gone them one better," so that, as we say, there may yet be ground for putting the Pennsylvania in the second place. The Central's block signals are to be electrically interlocked—the "Sykes" system—and a very large share of them are to have distant signals. The system of signals from Yonkers to Oscawana* has been pronounced by a competent critic to be the only thorough piece of signaling, of so great length, in this country. The two features mentioned, electric locks and distant signals, constitute the most conspicuous lack in the Pennsylvania's signal system, and either one of them would in all probability have prevented the Harrisburg collision. If there had been an electric lock at Steelton the operator there would not have sent the train forward too soon, and if there had been a distant signal at Dock street it would probably have been heeded by the engineer, and the train would have been stopped at the home signal.

But it is only just to say that the word "lack" is of doubtful applicability in this connection. The Pennsylvania has a well organized signal department; it has in charge of it the best men obtainable, and it has furnished them with liberal appropriations, with which the signal system has been constantly extended; and it must not be lightly assumed that this money has not been spent with reasonably good judgment. The Sykes locks are very costly and have been criticised as deficient in some safeguards which an electric lock ought to have. They are worthless where permissive blocking has to be allowed; the Pennsylvania has not been able to wholly abolish permissive blocking for freight trains, and there are objections to using electric locks for a part of the trains and not for the others. The value of distant signals is recognized by the Pennsylvania, for many of them are to be seen at its interlocking plants; but the failure to erect more of them, when the requisite money is so greatly needed for home signals or other equally important safety appliances at other points on the road, is not to be criticised off-hand by an outsider. Where there is no distant signal careful superintendents generally instruct the signalman to send word to the preceding tower that a block section is clear only after the last train has gone a certain distance beyond the end of it; and we understand that on the Pennsylvania the distance prescribed in this rule is *nine hundred feet*. This is much better than nothing as a substitute for a distant signal.

So that, altogether, there may be some justification for saying that the standard of the Pennsylvania is the normal one for a road of its class; that the New York Central, in ordering a 400-mile signal system, fully up to the requirements of, say, the busiest suburban road in the country, is spending money unevenly; is giving to signals what ought to go to other departments. Moreover, the elevation of the personnel, which costs a great amount of money, enters into the Pennsylvania problem, as we shall presently see.

The immediate problem with the Pennsylvania officers is in connection with the negligence of Hayes and Kelly. Wherein was their discipline defective, and what will guard against similar conduct in the future? Probably both men knew the rules, and probably both had broken them before. The defect in their characters is therefore largely of a moral nature, probably, and it cannot be discussed without some knowledge of the men and of the methods by which their sense of responsibility has been trained. But we may say, in passing, that to keep either signalmen or engineers at the highest standard requires more thorough discipline than even the best roads have yet introduced. Every superintendent knows certain individuals in his force

in whom nature and training have combined to make as good an engineman or signalman as can be made until we get angels to make them of, and if he is wise he desires to bring his whole force up to these ideals; but we have never yet heard of the superintendent who could get from his directors the money, the assistants, the time and the tenure of office, to accomplish that desire. All four of these elements are necessary to good discipline, but every superintendent seems to lack some one or more of them. Good discipline often seems to depend wholly upon the first element (the pay of the men), and, therefore, as we have intimated, a manager may spend money on signals that ought to go for wages, or *vice versa*, and it is a delicate matter to offer him advice in settling the question.

But though we cannot discuss the guilt of Hayes and Kelly intelligently, the officers of the Pennsylvania can, and they should tell the public the results of their investigation. Absence of well-known mechanical safeguards implies a confidence in the ability of the enginemen and signalmen to work safely without them, and the reasons for this confidence are of public interest just now. The Pennsylvania has secured favor by advertising the block system, and justly. The question now becomes one of details, and the passenger who trusts his life in the cars is as vitally interested in these details as in the main question. A signal tower in charge of a man of only a few months' railroad experience, and the spectacle of an express train running at 40 miles an hour on a rainy night around a sharp curve past a signal which should (on pain of death for disobedience) be approached under control, demand a very full explanation. The State of Pennsylvania takes no adequate means to give this explanation, and so it is incumbent upon the railroad company to do it.

Superintendents must not fail to notice that here, as in the New York tunnel collision, the flagging rules proved no help to the block system. It is true that the flagman of the first section might have gone farther and put down torpedoes before returning to his train; but rule 96, which governs in a case like this, distinctly encourages a flagman to omit the torpedoes, by providing that he need only make sure that his flag or light can be seen by the approaching engineman; an appeal to the engineman's ears is not contemplated by the rule, for he may be half a mile away. Very likely the stop at Dock street was long enough to require the flagman to be guided by rule 99, requiring the use of torpedoes and requiring him to stay back until the second section arrived (provided he knew that there was a second section); but if the Pennsylvania officers can make brakemen rightly adjust the scope of these two rules, 96 and 99, they have succeeded in doing what no one else has done. Estimating seconds of time is too fine a business to be put upon a brakeman in such circumstances. Expecting him to act contrary to the instructions given by whistle signal, when he looks upon the engineman as a sort of superior, is an unreasonable expectation, as things are.

If the brakeman of a passenger train, closely followed by a second section, strictly obeys the rules at every stop he will probably deprive the train of his services several times over in a single trip (that is, all the brakemen will have to be left behind) and the following train will have to be stopped so often as to introduce more elements of danger than are eliminated. It is all well enough to say that in this particular case the rule could have been carried out, but no one has ever succeeded in having it carried out consistently on a busy road; and if, in any given stoppage, the rear brakeman is on the train ready to go back, the chances are that it is because he has disobeyed the rule at some previous stoppage. If he had carried it out he would have been left behind. We emphasize these points because they so strongly support the demand, heretofore urged in these columns, that a block system on a busy road should be made as perfect as care and money can make it. As long as the safety of trains must be preserved by sitting on two stools—the space interval and the time interval—it will occasionally fall to the ground.

The Harrisburg case teaches one more lesson, which has to be learned from a collision every now and then, that of the necessity of strong cars. The stout Westinghouse car withstood the brunt of the shock, but protected its own occupants and transmitted the force of the collision to the weaker cars ahead of it. Thousands of trains are made up in this way, so that a part of the passengers secure a high degree of safety at the expense of another part. We cannot discuss this point in detail for we do not know the precise character of the framing of the cars in this train, but the duty of building cars strongly and of making up trains so as to distribute the force of shocks in the least dangerous manner is one whose importance ought to be more clearly impressed by this dis-

aster. Some managers have greatly promoted the safety of their trains as well as their own peace of mind by giving close attention to this question, and their example ought to be more generally followed.

May Accidents.

Our record of train accidents in May, given in this number, includes 61 collisions, 72 derailments and 8 other accidents, a total of 141 accidents, in which 66 persons were killed and 223 injured. The detailed list, printed on another page, contains accounts only of the more important of these accidents. All which caused no deaths or injuries to persons are omitted, except where the circumstances of the accident as reported make it of special interest.

These accidents are classified as follows:

COLLISIONS:	Rear.	Butt.	Crossing	and other.	Total.
Trains breaking in two.....	4	1	1	1	7
Misplaced switch.....	5	4	1	1	11
Failure to give or observe signal.....	7	3	5	1	16
Mistake in giving or understanding orders.....	1	4	1	1	7
Miscellaneous.....	8	4	4	1	17
Unexplained.....	5	4	7	1	17
Total.....	29	15	17	6	67
DERAILMENTS:					
Broken rail.....	1	1	1	1	4
Loose or spread rail.....	1	1	1	1	4
Failure of bridge.....	6	1	1	1	9
Defective switch.....	3	1	1	1	6
Defective frog.....	1	1	1	1	4
Defective roadbed.....	2	1	1	1	5
Broken wheel.....	6	1	1	1	9
Broken axle.....	3	1	1	1	6
Broken car.....	2	1	1	1	5
Broken truck.....	3	1	1	1	6
Fallen brakebeam.....	1	1	1	1	4
Failure of drawbar.....	2	1	1	1	5
Misplaced switch.....	2	1	1	1	5
Careless running.....	3	1	1	1	6
Open draw.....	1	1	1	1	4
Animals on track.....	6	1	1	1	9
Landslide.....	2	1	1	1	5
Washout.....	3	1	1	1	6
Malicious obstruction.....	2	1	1	1	5
Accidental obstruction.....	1	1	1	1	4
Unexplained.....	21	1	1	1	24
Total.....	72	15	17	6	110
OTHER ACCIDENTS:					
Boiler explosion.....	2	1	1	1	5
Cylinder explosion.....	1	1	1	1	4
Broken side rod.....	1	1	1	1	4
Other causes.....	4	1	1	1	7
Total.....	8	4	4	4	20

Total number of accidents..... 141

A general classification shows:

	Col- lisions.	Derail- ments.	Other acc'd'ts.	Total.	P.c.
Defects of road.....	11	14	14	39	27
Defects of equipment.....	4	17	4	25	18
Negligence in operating.....	41	6	2	49	35
Unforeseen obstructions.....	14	1	1	16	11
Unexplained.....	16	21	1	38	27
Total.....	61	72	8	141	100

The number of trains involved is as follows:

	Col- lisions.	Derail- ments.	Other acc'd'ts.	Total.
Passenger.....	24	19	4	47
Freight and other.....	37	53	4	94
Total.....	61	72	8	141

The casualties may be divided as follows:

	Col- lisions.	Derail- ments.	Other accidents.	Total.
KILLED:				
Employees.....	16	15	5	36
Passengers.....	10	10	1	21
Others.....	4	6	1	11
Total.....	30	31	6	67
INJURED:				
Employees.....	41	60	8	109
Passengers.....	45	63	3	111
Others.....	2	1	1	4
Total.....	88	124	11	223

The casualties to passengers and employees, when divided according to classes of causes, appear as follows:

	Pass. killed.	Pass. injured.	Emp. killed.	Emp. injured.
Defects of road.....	10	36	7	17
Defects of equipment.....	1	1	4	5
Negligence in operating.....	9	32	19	48
Unforeseen obstructions and maliciousness.....	1	18	5	35
Unexplained.....	1	5	1	4
Total.....	20	111	36	109

Thirty-four accidents caused the death of one or more persons each, and 24 caused injury but not death, leaving 58 (50 per cent. of the whole) which caused no personal injury deemed worthy of record.

The comparison with May of the previous five years shows:

	1892.	1891.	1890.	1889.	1888.	1887.
Collisions.....	61	67	68	48	63	35
Derailments.....	72	80	56	54	75	43
Other accidents.....	8	19	5	3	7	5
Total.....	141	166	129	105	145	83
Employees killed.....	36	54	43	23	23	16
Passengers killed.....	21	9	22	29	30	15
Others killed.....	11	38	28	68	99	33
Passenger trains involved.....	47	64	42	36	57	30

Average per day:

	4.55	5.35	4.16	3.29	4.68	2.68
Accidents.....	2.16	2.03	2.10	1.68	1.40	1.00
Killed.....	7.06	5.63	4.52	4.90	5.69	2.35

Average per accident:

	0.475	0.379	0.504	0.510	0.296	0.373
Killed.....	1.553	0.839	1.085	1.490	1.089	0.879

The record for May shows a dozen bad accidents, and the number of passengers killed is a third larger than in the three preceding months taken together. Eight were killed at Golden, Ark., on the 20th and six at Revere, Mo., on the 5th. The Golden collision was indirectly due to the great flood, but the immediate cause was carelessness on the part of the conductor and engineman, the same as in a serious collision reported in April. In fact, the list of butting collisions seems to be the one catalogue where we may be sure to find serious disasters with a good deal of certainty, if not regularly, every few months, if not every few weeks. It looks, some of the time, as if this column were usurping the place of honor (if heretofore accorded by general consent) to that embracing the rear collisions, as the most fatal and disgraceful feature of American railroading.

* A plan of these signals was shown in the Railroad Gazette of Jan. 15, though some slight details have since been changed.

It is plain that the railroads of this country need the block system on their single-track lines as badly as on double-track, if not worse. When we speak in this general way we do not forget that there are many roads whose record is very good in this respect, and we recognize the fact that it is not difficult to pick out a good many of them; more than one road in this country of considerable age and doing a good deal of business can show a record of complete immunity from disaster to passengers by butting collisions. But when, as in the past few months, we find some of the most frightful butting collisions occurring on roads regarded as the best managed in the country, the use of quite sweeping terms is found to be not only justified but required. One of the butting collisions this month occurred, we believe, on a piece of road where the block system is used for trains following one another, but is worked under rules which do not require the station operators to take any precautions against butting collisions. In another case, where an engineman forgot his train order, and was killed, it appears that the conductor and brakemen saw his mistake, and tried to stop the train, but were unable to do so in season. This is an instance, of a kind which we have pointed out before, where dependence on the rule requiring the conductor to check the engineman in case he makes a blunder, is a doubtful security if not indeed wholly useless. The circumstance, however, only makes clearer the fact that no other system can compare with the space-interval system for preventing collisions.

The disaster at Revere, Mo., is of a kind which certain Englishmen find great satisfaction in heralding as an illustration of the dangers of American railroad travel. It must be said that their view of the case is not wholly unwarranted, although the possible dangers are not so great as they are generally made to appear, and the illustration, when used by Europeans, is generally applied to cases in which it is more or less irrelevant; but the fact remains that long stretches of road, owned by companies too poor to maintain a complete system of track inspection, are built with a great many wooden trestles, and are thus peculiarly exposed to danger from fire and flood; and these very roads are used for the conveyance of through passengers both night and day, and at speeds which are proper only on a safe road. The train at Revere is reported to have been running at a very slow rate, but the melancholy result shows that, slow as it was, it ought to have been still slower.

One of the collisions in the list printed to-day is said to have been caused by the extinguishment of the light in a train order signal, but no explanation is given as to why the runner passed a telegraph office showing no signal or an imperfect signal, without finding out the cause of the failure.

At Toledo, O., on the 13th, two electric street cars broke through a bridge over the tracks of the Lake Shore & Michigan Southern road, and fell upon a freight train standing beneath. The motorman was crushed to death, but the presence of the freight train probably saved the other occupants of the cars. In San Francisco on the 2d, 13 persons were injured by a derailment on a new electric railroad. On the Manhattan Elevated in New York City, on the 27th, a passenger train ran around the curve at Ninth avenue and Fifty-third street, which is only about 150 ft. radius, at 20 miles an hour or faster. The train stayed on the track, but most of the passengers were scared half to death. On the New York Central, near Palatine Bridge, May 5, a freight engineer was killed in his cab by blows received on his neck and head; but so far as can be learned from the reports, no one was able to discover how the injuries were inflicted. On the 2d, near Oklahoma City, a rear collision of freight trains was occasioned, though not caused, by the rupture of an air brake hose, which, of course, brought the train to a sudden stop.

The manner of the destruction of the false work of the bridge over the Licking River at Newport, Ky., is made tolerably clear by the report which appears on another page. First, a segment of the top chord, of two panels length, fell destroying the traveler and the false work immediately under the traveler. Then the false work fell toward the breach. The immediate cause of the fall of the portion of the top chord which wrecked the traveler will probably never be known. It is quite possible that there was a simple failure of some stick under the weight; for it is customary and proper to use the same timber over and over on different jobs, and some stick in this traveler may have passed the safe limit of soundness. It is obvious that if the false work had been braced longitudinally the wreck would have been much less extensive.

In discussing the Harrisburg collision we have said that the State of Pennsylvania fails to give due publicity to affairs of this kind, by which we mean that there is no properly qualified railroad commission; but in this particular case the coroner's inquest, though by no means thorough, has brought out the facts much better than is generally the case, and a fair idea of the disaster may be gained from the published reports. This may be owing to the very reasonable policy of the railroad officers, who seem to have withheld nothing. They are also much praised for their exertions in behalf of the injured and afflicted. The verdict of the jury finds H. S. Hayes, the operator at Steelton, guilty of gross neglect, Robert M. Brown, flagman, guilty of neglect in not go-

ing back far enough and placing torpedoes on the track, and remaining until the second section arrived; Hugh Kelly, engineer, guilty of the same charge for not having his train under full control on approaching Dock street. The railroad company is censured for allowing the freight train to be on the passenger track on the time of an approaching passenger train. This is all substantially just except the last sentence. Brown disobeyed a plain rule, but, as we have intimated in our discussion, his punishment should be very much milder than Kelly's and Hayes'. But the censure of the company is based on the old notion that a time interval is the proper preventive of collisions; whereas a busy road must use the space interval, and having adopted it, should not temporize with the old system.

The law requiring interchangeable mileage tickets was finally passed in the Massachusetts legislature, and it is to go into effect Oct. 1, though all the other bills affecting railroads were defeated, we believe. This law provides that:

1. Every railroad corporation operating within this Commonwealth shall provide and have on sale, for \$20, mileage tickets representing 1,000 miles, which shall be accepted and received for fare and passage upon all railroad lines in this Commonwealth, as well and under like conditions as upon the line or lines of the corporation issuing such ticket.

2. Such tickets or any part thereof shall be redeemed by each corporation issuing the same, upon presentation by any other railroad corporation.

3. On petition of any railroad corporation included within the provisions of this act, filed with the Railroad Commissioners, asking that it may be exempt, or that any other railroad be excluded from the provisions of this act, said Commissioners may in their discretion exempt or exclude such railroad from the provisions of this act, if in their judgment the public welfare or the financial condition of the road require or demand it.

Some of the roads now issue 1,000 mile tickets at \$20, good for bearer, but it is not likely that any of them will be willing to accept such tickets issued by other companies, so it will apparently be necessary to return to the former plan of restricting all two-cents-a-mile tickets to the buyer's own use. The first section of the law seems to prevent the issue of more than one form of 1,000-mile tickets at the rate named. If, however, the restriction of the tickets should check travel, unlimited tickets, for use only on the home road, could be issued at a lower rate, say \$19.50.

The Northern Pacific, which was interrupted several days by washouts in Montana, suffered still further damage the latter part of last week by a new flood. One dispatch states that a dam which had been formed in Hell Gate River was blown up with dynamite, and that the water then liberated did great damage to the roadbed for 20 miles. Heavy rains have been general throughout large sections of the country during the past week. At Galena, Ill., the town was flooded, and the Illinois Central lost an important bridge which had been ineffectually loaded with cars of stone. The Chicago, Burlington & Northern had a large number of land slides near Galena, and the Chicago & Northwestern was badly washed. The Chicago, Rock Island & Pacific suffered in a similar manner near Ottawa, Ill. The Mississippi River is still very high throughout its length. The Illinois Central has had some new trouble near New Orleans this week. A reservoir at Pottsville, Pa., began leaking on June 22, and became so dangerous that the Philadelphia & Reading railroad suspended traffic on a portion of its line. Many people vacated their houses and a telegraph wire was fixed up to keep the town warned of the condition of the dam.

Mr. Coffin appeals to railroad officers to be teetotalers, and to wear a badge to indicate the fact, so as to encourage their subordinates. He says he is willing to spend thousands of dollars, personally, to furnish the badges, and will give them away. We take pleasure in printing his letter, and have no doubt that many superintendents can elevate the service on their roads by this kind of moral example; but every trainman or other person handling trains, messages, switches or signals should bear in mind that temperance is required of him as a matter of business; and that, as a matter of business, he can find no fault if the directors choose to hire a superintendent who is not a total abstainer. A superintendent can befuddle his brain without immediate danger to life or property, while trainmen and station men cannot. He can neglect his work for a time without specific harm to the company; they cannot neglect theirs for a moment without danger.

A correspondent in Texas writes that freight conductors on the Atchison, Topeka & Santa Fe made in the month of May \$240 each, and brakemen averaged for the same month \$170. Engineers and firemen made \$275 and \$160 respectively. It would be interesting to know what proportion of this money was for "delays" on the road, computed by the hour. On most roads these figures would indicate some pretty tall loafing. Perhaps, however, the trip rates are extra high in Texas. It is somewhere in that region, we have heard, that the trainmen and not the superintendents fix the rates.

NEW PUBLICATIONS.

Experiments with Alternate Currents of High Potential and High Frequency. By Nikola Tesla. A lecture delivered before the Institution of Electrical Engineers, London, with a portrait and biographical sketch of the author. New York: The W. J. Johnston Co., Limited, 1892. 16 mo.; pp. 146. Price \$1.

This is a reprint of a lecture now celebrated, and is in a form for convenient preservation for reference. Doubtless this lecture, with the one which preceded it, delivered before the American Institute of Electrical Engineers, and which it would have been desirable to include in this volume, will, for a long time to come, be regarded as marking the beginning of a new epoch in the use of and acquaintance with the phenomena of electricity.

Although the earlier dynamos were alternating current machines and much simpler than those afterward constructed for the production of the direct current, the convenience for use of this direct current in the arts attracted greater attention to its study, leaving the alternating current to be comparatively neglected. Nevertheless, Mr. Ferranti, Prof. Ferraris and Mr. Tesla have been conspicuous advocates, each in his own way, of the superior value of the alternating current. Yet it was not until very lately that the extraordinary characteristics of currents of high potential and high frequency, which are illustrated in this little volume, were suspected. They could not be produced except by machines of special construction which did not exist and which could only have been designed by persons profoundly versed in the laws of electricity so far as they had already been discovered, and who were determined on pushing their inquiries into the unknown.

The results of these researches have been more important and more wonderful than even the most experienced could have anticipated, revealing new phenomena and new capacities altogether unsuspected. In reading this lecture one is agitated by an emotion of sympathy at the view of this young philosopher, standing on the platform where Faraday exhibited his early discoveries, and in the presence of the past-masters of science, with a modesty equal to Faraday's, announcing: "Even at this hour possibilities not dreamed of before are by the use of these currents partly realized. As in nature all is ebb and tide, all is wave motion, so it seems that in all branches of industry alternating currents—electric wave motion—will have the sway."

We read with amazement how the space about the platform becomes charged with "lines of force," a tube waved about in this space glows with incandescence; lamps glow on being touched by the hand of the lecturer; a wire many miles long sends forth streams of light from its distant end when the other end is brought into contact with his body. We see it demonstrated that to these currents the best dielectrics are as permeable as glass is to light, and, indeed, that they aid rather than impede the passage of a discharge. We witness the rotation of the motor without any connection except the ground between it and the generator, and we are prepared for Mr. Tesla's prophecy to be realized. "We shall have no need to transmit power at all. Ere many generations pass our machinery will be driven by a power obtainable at any point of the universe."

We are enabled somewhat to comprehend the great difference between these currents, and such as we have been accustomed to hear of or to see experimented with, by looking at the figures representing the numbers of vibrations or alternations employed respectively in their production; for the ordinary dynamo imparts say 100 alternations a second whereas the new machine is capable of 20,000 a second; which by means of condensers Mr. Tesla increases to 1,500,000 or more a second. Most strange perhaps of all discoveries with regard to these currents, so intense in their potential and their frequency, is the fact of their harmlessness. The lecturer passed them through his body, stood, surrounded by their effects, insensible of any action upon his own system.

The language of the lecture is so elegant, clear and simple as to make it interesting and understandable by those who are only partly acquainted with electrical science. It is only by reprinting the whole of the charming volume that we could give any complete view of its valuable contents.

The Official Railway List and Hand-Book of Useful Information for Railway Men; eleventh year. Chicago: The Railway Purchasing Agent Company, 1892. Price, cloth, \$2.

It is too late in the 19th century to say much about this list, which is known from Dan to Beersheba. It is convenient, and is accurate enough for practical purposes, and we are not inclined to grumble about it except in one particular, and that is, that the titles of the officers ought to be set in italics or full face type for the greater comfort and convenience of the man who has occasion to use the list. This we have said every year for five years, and so far with no result. But constant dropping will perhaps affect even the stony heart of a Chicago publisher.

TRADE CATALOGUES.

The 2 x 24 Flat Turret Lathe. Jones & Lamson Machine Co., Springfield, Vt.

This is a remarkably well-illustrated pamphlet, with wood cuts by one of the best engravers, showing the flat turret lathe as a whole and in detail, with its various tools, and also many specimens of work done by it. There is, besides, an excellent general description of the machine. The first machine of this sort was delivered after Jan. 1, 1891, and the manufacturers say that they "believed at that time that this was much superior to all other machines for the rapid and accurate production of lathe work within its capacity. Since that time the unprecedented sales and the broad testimonials from men of the highest standing and integrity, have given us

unmistakable evidence of the correctness of our judgment." The machine does lathe work up to 24 in. long and 2 in. in diameter, and it is certainly a tool of great range and accuracy.

Gold Car Heating Co., New York and Chicago. Supplementary Catalogue.

Mr. Gold is so fertile in devices that it is apparently necessary for him to issue new editions frequently to keep the world posted as to all of his improvements. We are bound to say, as we have often said before, that notwithstanding the number of contrivances for the better heating of cars that he has brought out, they are almost without exception singularly ingenious and mechanical. Among other items of interest contained in this catalogue is the following letter from Mr. Samuel Sloan, President of the Delaware, Lackawanna & Western Railroad Co., dated May 1, 1892:

"In reply to your letter asking what I think of the 'Gold Heater' for heating railroad cars, I can only say that we have tested them thoroughly for four winters, having equipped our entire road (nearly 500 cars), working satisfactorily. The storage heaters are clean, healthy, safe, comfortable and economical."

Catalogue and Price-list of Presses, Drop Hammers and Various Special Machinery. E. W. Bliss Co. (Ltd.), 17 Adams street, Brooklyn, N. Y.

The E. W. Bliss Co. (Ltd.), which now includes also the Stiles & Parker Press Co., issues a very complete catalogue. It has 300 pages, thoroughly illustrated and bound in flexible muslin. The volume makes an excellent reference book of presses, dies, and special sheet metal machinery. It would be quite impracticable to give any but the most general statement of its contents, which include punching and shearing presses, embossing presses, forging presses, drop hammers, engine lathes, and so on.

Steam Shovels and Steam Dredges. The Vulcan Iron Works Co., Toledo, O.

This catalogue shows by direct reproductions from photographs the "Giant" Railroad Excavator and Wrecker, from one having a capacity of $2\frac{1}{2}$ cu. yds. and weight of 70 tons, down to a capacity of $\frac{1}{4}$ cu. yd. and weight of 18 tons. These vary in prices from \$4,500 to \$10,000. There are very fair descriptions, also, of these steam shovels, with letters from users. Several dredges with a wide variation in price and capacity are also illustrated.

The Hutchins Freight Car Roof. C. B. Hutchins & Sons, Detroit, Mich.

In a little pamphlet of 26 pages is reprinted a paper read within a few months before the Northwest Railway Club on the subject of Car Roofs. Extracts from this paper were published in the *Railroad Gazette*. A special description of the Hutchins roof, with directions for using it, and some miscellaneous information are also included in the pamphlet.

Wakefield Triple-Lap Sheet Piling. Wakefield Sheet Piling Company, Chicago, Ill.

This is a small pamphlet containing a description and illustrations of sheet piling composed of three planks of equal widths, bolted together to form in combination tongued and grooved piles. A good many advantages are claimed for this style of piling, and the letters included in the pamphlet from contractors and engineers speak very highly of it.

Manual of Standard Wood Working Machinery. The John A. White Co., Dover, N. H.

This is a very small catalogue, which the publishers say is issued in advance of a complete catalogue. It gives perspective views of hand saws, circular saws, swing saws and saw benches in considerable variety. Planers, matchers and benders, mortising machines, boring machines and other wood working machinery are illustrated.

Coburn Patent Trolley Track. The Coburn Trolley Track Manufacturing Co., Holyoke, Mass.

Among the considerable assortment of material illustrated in this catalogue are trolleys and door hangers for cars, shops, mills, etc.

Building the Baltimore & Ohio Railroad.

ANNUAL ADDRESS BEFORE THE AMERICAN SOCIETY OF CIVIL ENGINEERS, BY THE PRESIDENT, MR. MENDES COHEN, DELIVERED AT THE OLD POINT COMFORT CONVENTION, JUNE 8, 1892.

A provision of the Constitution of the Society requires that the President shall deliver an address at the annual convention, and in compliance therewith I have the honor to appear before you this evening. As I have not been of late years actively engaged in the practice of our profession and am for that reason unable to give from personal experience notes of recent works and improvements, marking the strides of current progress in the science of engineering, it has been suggested to me that you would be interested in an historical narration of some of the events and problems of a much earlier period and the manner of meeting them in the construction, development and operation of the Baltimore & Ohio Railroad. It must not be understood from my assuming to act upon this suggestion that I was one of those upon whom these early duties and responsibilities devolved. I was not born until some years after the 4th of July, 1828, when the venerable Charles Carroll, of Carrollton, then the only survivor of those who signed

in 1776 the charter of our liberties, turned the first sod and laid the first stone of the Baltimore & Ohio Railroad. But many of the original actors and participants in these events were still upon the stage when, as a youth, I entered the locomotive shops of the late Ross Winans with a view to preparation for the profession of a civil engineer.

Mr. Winans, a native of New Jersey, was himself a most prolific inventor, and had produced previous to 1829 an improved journal and box which he thought suited to railroad use, and which he went to England to test on the Liverpool & Manchester Railroad, then under construction. He was there present when the celebrated trial of locomotives took place in 1829, and the opportunity thus afforded him for a study of the locomotive was not lost and was subsequently of much value both to himself and the railroad company. His journal and box were adopted on the Baltimore & Ohio Railroad, and he, taking up his permanent residence in Baltimore, had been continuously thereafter engaged in designing and constructing cars and locomotives adapted to use on the railroad. In and about the establishment of Mr. Winans and the railroad works adjoining were many of the men who had been employed at the very commencement of the undertaking, the actual participants in which have now nearly all passed away. These men I used to meet constantly, and entering myself into the service of the railroad company a few years later while many of the original features of the work were still in existence, I had opportunities of acquiring facts and of observing details not so readily gathered or noted to-day. Being in this sense only a survivor of that early period, I venture to bespeak your interest and attention to some of the more prominent details of the work, in which there was much originality. Many of these facts are known to some of you, many of them are here gathered from the original reports and other records of the time, some from a "History of the Railroad," prepared in 1853 by the late Wm. Prescott Smith, and others from the personal reminiscences of survivors, but I am not aware that they have ever before been brought together.

In 1825 Baltimore was a city of about seventy thousand inhabitants. Its people were enterprising and had developed with the country beyond the Alleghenies a large trade, transported in wagons, over good turnpike roads while the foreign commerce of the port conducted in its home built, fast sailing vessels, known everywhere as "Baltimore Clippers," extended to all parts of the world. Its geographical position, giving it a saving of from one hundred to two hundred miles in distance to the Ohio River at Wheeling over that from Philadelphia or New York to the same river at Pittsburgh, was sufficient, when land transportation was effected only by horse and wagon, to give it an enormous advantage. Philadelphia and New York were making strenuous efforts to retain their trade and to this end were pressing forward their respective lines of canal, the future possibilities of which, aided by steam navigation then rapidly developing, no imagination would limit.

Baltimore had not failed to realize clearly that action was necessary. It was believed that the valleys of the Potomac and Youghiogheny rivers would afford a route for a canal quite as advantageous as any to the north of it. Washington himself had taken much interest in such a project, and had presided in December, 1784, at a meeting in Alexandria, at which the Potomac Company was formed for improving the navigation of that river. In 1824 a charter for the Chesapeake & Ohio Canal was granted by Virginia and Maryland. Into this corporation was merged the Potomac Company, which had thus far only accomplished the opening of a partial slack water navigation. Preliminary surveys for the canal had been made and some definitive location effected when the hopes of Baltimore as to its commercial success were completely upset by the report of General Bernard, of the Board of Engineers on Internal Improvements, who, in 1826, showed not only the very great cost of the work, but that the scarcity of water on the Alleghenies at the high elevation over which the canal must pass made its successful accomplishment very problematical; besides, its proposed eastern terminus was Georgetown on the Potomac, and to reach Baltimore from that point would involve an additional crosscut canal some 50 miles in length.

The opening of the Erie Canal in 1825 aroused the merchants of Baltimore to a full sense of impending decadence, and discussions of the subject were constant between the more thoughtful of their number. If the projected canal was out of the question, what were they to do? Competition by the best of turnpike roads was hopeless! At this time attention was being directed in England to the possibilities of railroads for general transportation purposes. Numerous short lines were already in existence there and a very few had been laid even in this country, but so far they were designed chiefly, if not altogether, for the purpose of moving mineral products from mines or quarries to a convenient point where water transportation would be available and were, in fact, what we would term to-day mere tramways and only operated reliably by horses. Might not this new system be made available on a larger and much more extended scale for connecting Baltimore with the western waters? So thought Philip E. Thomas and George Brown, two of these Baltimore merchants. Having facilities for obtaining information from England in regard to what had been done there, these gentlemen took pains to procure all that was available from that source

and with it in hand they invite a few of Baltimore's most influential citizens to meet them for the purpose, as their call stated, "To take into consideration the best means of restoring to the City of Baltimore that portion of the Western trade which has been lately diverted from it by the introduction of steam navigation and by other causes."

This meeting was held at the residence of Mr. Brown on Feb 12, 1827. It was well attended. After hearing read and discussing the various documents and statements illustrating the efficiency of railroads for conveying articles of heavy carriage at a small expense and the superior advantage of this mode of transportation over turnpike roads or canals, a committee was appointed to consider the subject, and was directed to report to an adjourned meeting one week later. At this adjourned meeting it was determined to apply to the legislature, then in session, for a charter for the Baltimore & Ohio Railroad. This was obtained in the following month in such a comprehensive form that it remains to this day a monument to the forethought of those who prepared it. This was the commencement of the Baltimore & Ohio Railroad Company, the first railroad enterprise undertaken for so general commercial purposes, certainly in the United States, and far exceeding in magnitude anything then being promoted in England.

Organizing at once under this charter, Philip B. Thomas became the first President of the company, and with an efficient Board of Directors lost no time in prosecuting the work. Application was made to the United States Government for a detail of officers to conduct reconnaissances and surveys, to be at once undertaken whilst the company would take time for the careful selection of a suitable chief engineer. In response to this application there were detailed to the railroad service, S. H. Long, Brevet Lieut.-Col. U. S. Topographical Engineer; William Gibbs McNeill, Capt. U. S. Topographical Engineers; Dr. William Howard, U. S. Asst. Engineer; assisted by Mr. F. Harrison, Jr., U. S. Asst. Engineer; Lieut. Joshua Barney, U. S. Artillery; Lieut. Isaac Trumble, U. S. Artillery; Lieut. John L. Delahanty, U. S. A.; Lieut. Walter Gwynn, U. S. A.; Lieut. William Cook, U. S. A.; Lieut. Richard E. Hazzard, U. S. A.; Lieut. Geo. W. Whistler, U. S. A.; Lieut. Fessenden, U. S. A.; Lieut. Thompson, U. S. A., and Mr. Guion.

The duty assigned to these officers was performed with so much assiduity that they were enabled to present on April 5, 1828, a report which covered a general examination of the whole intervening region between the Patapsco and Ohio rivers and with so intelligent a discussion of many of the alternative lines that it is a matter of no little wonder how so much could be accomplished in so short a time through so rough a wilderness as the Alleghenies must have been in that day. The study of the route seems to have been based on the theory that the gradient of the road, to be worked probably by horses, possibly by locomotives, must be moderate, not exceeding 30 ft. per mile, as nearly uniform as possible never undulating, that a very liberal amount of lateral curvature was admissible in furtherance of this, and for the avoidance of heavy cuts and fills; and that where summits were to be crossed and great differences of level to be overcome recourse should be had to inclined planes to be operated preferably by steam or water power.

The company had in the meantime secured the services of Jonathan Knight, Esq., of Pennsylvania, a civil engineer of experience, who had been engaged upon the National Road, between Cumberland and Wheeling, and who had served more recently under appointment of the United States Government as a Commissioner to extend that road from Wheeling through the states of Ohio and Indiana. A few days after the filing of the report of reconnaissances and survey, the engineering department was organized by placing it in charge of a Board of Engineers, consisting of the President of the company, Mr. Philip E. Thomas, Col. S. H. Long, U. S. Topographical Engineers, and Jonathan Knight. The President had no knowledge of engineering, so there were two professional men, with a layman to vote with one or the other, and make a majority whenever a difference of opinion supervened. Captain McNeill was subsequently on Oct. 6, 1828, appointed a fourth member of the board. On May 5, 1828, the Board of Engineers made a formal report recommending to the company the adoption of a route by the valley of the Potomac as affording by far the best passage through the South Mountain, involving, too, the crossing by inclined planes of but one summit, that of Parr's Ridge, before reaching the Potomac. A few days later parties were started in the field to make definitive location of the line. It is curious to note that in the midst of their labors in the location of a great line through a difficult country the Board of Engineers found they had quite as difficult a problem to solve in meeting the views of the citizens of Baltimore as to the city terminus of the line. Every merchant wanted it at his own door, and it was many years before the question was put to rest.

On July 4, 1828, formal commencement of the work was made by the laying of the first stone by Charles Carroll, of Carrollton, attended by a great procession and trades display, badges, music, etc., and on the 14th of the same month the first letting of the work took place. That there was no time being then lost is clear, for at the annual meeting, less than 90 days later, the President reports that the grading of one and one-half miles was complete.

Simultaneously with the location of the line at Baltimore a party had been sent to locate the road through the Narrows of the Potomac, at and beyond the Point of Rocks where it was feared there might be contest with the Chesapeake & Ohio Canal Co. This was promptly effected and was followed by the acquisition of the coveted ground in the fee simple, though to no purpose, as it presently appeared, for in the same annual report of Oct. 1, 1883, the President announced that the canal company laid claim to a pre-emption right to a location along the Potomac River through succession to the rights of the old Potomac Company. Injunction immediately stopped the work of the railroad and company along the Potomac, and the litigation thus commenced was prolonged for several years, ending finally in the triumph of the canal company.

The same report announced the intention of the President and Board of Directors to send to England a deputation of engineers to make observations there, and especially to study the application of moving power upon the roads then existing. Mr. Knight, Captain McNeill and Lieutenant Whistler, were accordingly sent abroad in November, 1883. They made a very thorough examination of all the railroads then existing in England, and returned to Baltimore May, 1889. The report of their observations, though promised, was deferred, and if prepared seems never to have been formally presented and never printed.

At their very first meeting on the 12th of April, 1883, the Board of Engineers appointed Mr. Caspar W. Weaver, Superintendent of Construction, "whose duty it should be to aid in arranging contracts for the execution of work upon the railroad and to see that all contracts for the construction of said road be faithfully carried into effect, and also to perform such other duties connected with the service as the Board of Engineers may direct." Mr. Weaver had been engaged in a somewhat similar capacity on the construction of the National Road, from Cumberland to Wheeling, and its continuation in Ohio; and, although probably not equipped with a scientific education, had acquired considerable experience and practical skill in dealing with contractors and pushing public works. The Board of Engineers, on the contrary, with a most cumbersome organization, was dealing with entirely new problems, where precedents and past experience were of little avail. The Superintendent seems to have thought he possessed far more knowledge of the subject than his engineers, and would brook no control. He seems to have recognized their general lines of location, but modified and changed them occasionally as he thought fit. The Board of Engineers adopted in its printed regulations a thorough system in accordance with the military training and habits of a majority of its members, and not differing from the methods observed in government work. Mr. Knight united with his colleagues in the adoption of these regulations, all of which were doubtless right in themselves, but they were not elastic enough for the views of Superintendent Weaver, who did pretty much as he pleased, without the slightest attention to regulations when he chose to ignore them. It is very evident to one who studies the record to-day that the Superintendent had the ear of the President and was sustained by him and the Board of Directors. They wanted the work driven with energy in order to impress the public with confidence in the success of a new and untried enterprise, for the company was seeking support and subscriptions to its stock from both the State and United States Governments. Mr. Weaver seems to have rushed things, which was what they wanted, and the man who, without drawings or prepared plans, would assume to put contractors to work on dressed stone viaducts of 80, 55 and 20 ft. spans, at an estimated cost but little exceeding that which the Board of Engineers had named as the cost of wooden superstructures, adopted by them for economy, was the man for the day. Colonel Long seems to have had much trouble from this cause during the absence of his colleagues in England. On their return in May, 1889, there was an investigation; charges were preferred against the Superintendent, such as changing location without authority, injudicious dealings with contractors, entire disregard of certain specific orders of the Board of Engineers, etc. A hearing was had before a committee of the Board of Directors, which acquitted the Superintendent of all charges affecting his integrity, and practically sustained him throughout.

The Board of Directors soon thereafter, on Jan. 4, 1890, abolished the Board of Engineers and appointed Jonathan Knight as Chief Engineer. This action gave rise to much acrimonious discussion in the newspapers of the day. A pamphlet of some 500 pages was published giving minute details of the work of the Board of Engineers from the first organization of the board to its final dissolution; and this, in connection with other pamphlets and newspaper articles, gives a pretty clear insight into the actual condition of affairs. A study of it is interesting as showing how the engineers were led, principally by local jealousies as to the point of entrance into the city, combined with a supposed necessity for avoiding undulations in the grade which had been located as a level for the first six or seven miles to the adoption of a most expensive line within the first three miles from the city, involving a costly viaduct and one through cut of 310,000 cu. yds. It was thought by this location "a line of road would be secured, which, by

some extensive embankments and sharp cutting near the city, could be located with but a single summit for a distance of 180 miles, and with but two summits requiring stationary power along the entire distance to the Ohio River."

It enables us further to appreciate how thoroughly novel and untried were the problems involved. We find an elaborate defence of the proposition that the flanges of the wheels should be on the outside of the wheel and rail, an arrangement which the Board of Engineers had adopted and in accordance with which one and one-half miles of track had been actually laid, when shortly after the abolition of the Board of Engineers, the Chief Engineer changed it to that which was then used abroad, and which has since everywhere prevailed. Mr. Knight, in his annual report of October, 1890, explains the reasons for the change of plans and discusses the question very fully, the result being that, while his analysis would seem to justify the conclusion that the flange was better on the outside and in that position peculiarly well suited to Mr. Winans' patent car, which it was proposed to use, yet as experiments on the Liverpool & Manchester Railroad had shown that this car would work well with the flanges inside, it was desirable that a railroad which must be a general thoroughfare and probably intersected by numerous branches should be suited to all approved kinds of carriages, of which all, so far, had inside flanges. Hence the conclusion to adopt upon this road the form already in use elsewhere.

The same report contains an elaborate discussion and analysis of the size, weight and form of the chilled cast-iron wheel to be used on the road, with the proper amount of cone to be given to the tread, resulting in a pattern which was standard for the next 20 years or more. Of cars, a number were constructed at this time with case-hardened or steeled journals and chilled bearings, a system which also continued in use for over 20 years.

Here I must mention the name of John Elgar, Mr. Knight's mechanical assistant, who was employed in designing and constructing wheels, chairs and turnouts or switches. The latter were still used in and about the yards and street tracks of New York some 25 years later, where they were known as Baltimore switches. When I knew Mr. Elgar, 45 years ago, he was an old man of about 70 years, gentle and minutely painstaking in all he did. He was then interested in water rams, which were constructed for him in Winans' shops. I was frequently assigned to his work and learned to know him well. In fact, the first time I ever held a target was for him in running a line of levels for setting one of his rams to supply water to the Baltimore House of Refuge. The level he used was peculiar. He was too poor to buy an ordinary telescope level and much too independent to borrow one, so he made his own: Its use did involve the necessity of being reasonably careful about equal sights, but it served his purpose well, and the four silver quarters which he insisted on my accepting for my afternoon's duty as rodman, was the first pay I ever received for engineering work.

The dissolution of the Board of Engineers was soon followed by the retirement from the company's service of all the United States officers heretofore attached to it. They were all men of ability, and each and all subsequently made a record elsewhere; but it is very evident that the President and Board of Directors had effected a most impracticable organization at the start, under which it was well nigh impossible to produce good results.

The track was to have been laid throughout on stone sills, but owing to the scarcity of stone until the valley of the Patapsco could be reached, and for the further reason that the embankments constructed without regard to the directions of the engineers, who had ordered them built in compact layers of full width, as you would build an earthen dam, were not sufficiently settled to afford a proper bed for the stone, it was deemed best to lay the first 7¼ miles with wood. Sleepers or cross ties of 7 ft. to 8 ft. in length and of from 5 in. to 10 in. in thickness were laid transversely on the road at a distance of 4 ft. from centre to centre. Notches were formed in each sleeper at proper distances to receive stringer pieces 6 in. square and from 12 ft. to 40 ft. in length. These were held in place by wooden keys. Under each notch of each sleeper a cavity was excavated in the graded bed to receive 1½ cubic feet of broken stone of a size to pass through a 2-in. ring. This cavity was arranged 18 in. lengthwise on the sleepers and 12 in. lengthwise of the road and 12 in. deep. Each sleeper was laid so as to rest firmly on these supports of broken stone. The iron rails, 15 ft. long by 2¼ in. wide and ¾ in. thick, were laid on the stringers about ¾ in. from the edge. Iron plates having been let into the wood immediately under the joinings of the iron rails, the ends of each two adjoining rails were fastened to the plate by a screw bolt or nut, or by a nail or spike. The rails were laid ¼ in. apart, with mitred joints, and were nailed to the wood throughout through holes made in the rail for the purpose. The projecting corner of the stringer was then adzed off that the flange of the wheel might not come into contact with the wood. On the unsettled embankment sub-sills were used under the sleepers or cross ties.

For the first seven miles a double track was constructed of this description and on the next six miles which carried the work to Ellicott's Mills, one track was

made with the wooden stringers on stone blocks about 16 in. square by 12 in. long, bedded in broken stone, instead of on wooden sleepers or cross ties. The rails were secured to the block by cast iron knees. The other track consisted of stone sills about 10 in. wide by 12 in. deep, bedded in broken stone, forming a continuous base for the iron strap rail.

The latter was the standard track, and it is recorded in the reports as believed to be the best known, and superior to the iron rail in use in Europe. Its cost was \$2,000 a mile for each track more than the wooden stringer, but its supposed permanency recommended it to the company wherever the proper material could be had.

It was not long, however, before experience began to enlighten the officers to a fact which the President announced a little later—that of the several systems of superstructure just described, the first intended to be but temporary was decidedly the best, and the last as decidedly the worst of all. The track was finished with a horse path of gravel of broken stone and was opened for use to Ellicott's Mills on May 21, 1830, being operated by horses. Among the Assistant Engineers in charge of the track laying are found the names of J. Dutton Steele and Squire Whipple.

So much extra expense had been involved in the laying of new track with the stone sills, owing to the distance from the quarry and the difficulty of distributing them ahead of the track, together with the evident inexpediency of using them on unsettled embankments, that as the work proceeded west of Ellicott's Mills the Chief Engineer suggested whether the extension could not be more advantageously laid with wood, leaving stone, or other improved methods, to be availed of for renewals. This policy was not adopted, however, until about 40 miles of single track had been laid with the stone.

In his annual report of Oct. 1, 1890, Mr. Knight speaks with much satisfaction of the readiness with which a speed of 10 miles an hour has been maintained with horses in the working of the 13 miles of road then in use for four or five months. He refers, too, to the recent eminently successful demonstration of the applicability of the locomotive to a railroad with curvatures of 400 ft. radius as proved by the trial upon the road of an experimental engine built by Peter Cooper, of New York. The engine was rudely constructed, had but a single working cylinder of 3½ in. diameter, and was mounted on the ordinary 30-in. car wheels which were driven from the engine shaft through the medium of gearing. This, the first trip of the first locomotive built in America, took place on Aug. 23, 1830. A most graphic description of the trial trip was prepared many years ago by the late John H. E. Latrobe. No doubt many of you recall it, and I will not detain you with further reference to it than to say that the machine was a mere experiment to prove to the skeptic that the sharp curves of 400 ft. radius, or even less, could be readily worked by steam applied through the adhesion of the wheel to the rail. Peter Cooper was interested in proving this, for he was the largest owner of shares in the Canton Company of Baltimore, a real estate corporation that all who know anything of the New York stock market have heard about. Peter Cooper believed that his company's lands were only to be made valuable by the successful development of the railroad project, and he was right. The full recognition of their value is, however, only now being realized, after an interval of 60 years.

During this and the following year experiments were made to test the resistance of cars with the Winans anti-friction box and those with hardened steel journals and chilled bearings. With the former the friction on a level, straight road was found to be about half that of the load, and with the latter, about two-thirds of the same.

Experiments were also made to test the practicability of turning the street corners of the city with the railroad and cars. It was found that a radius of 50 ft. could be readily turned by permitting the wheels on the outside of the curve to roll on the edge of the flange, which was guided by the flange running in a groove in the rail, while the inside or shorter rail remained of the usual form and carried the trend of the opposite wheel.

In his annual report of Oct. 1, 1831, Chief Engineer K. acknowledges the aid he has received in the arrangement of the machinery from his assistants, John Elgar and Ross Winans, the latter of whom was then engaged in planning the machinery and fixtures for the inclined planes, which was never, however, brought into use.

The directors, being desirous of procuring their steam machinery as far as practicable of American workmanship and anxious to direct the mechanical genius of the country to its further improvement, published on January 4, 1831, an advertisement for locomotives. In this advertisement \$4,000 is offered for the most approved engine and \$3,500 for the next best, the engine to burn coke or coal and not to exceed, in running order, the weight of 3½ tons, not inclusive of tender. Three locomotives were offered to the company in response to this advertisement. Of these only one was found to come up to the requirements of the specification. This engine was the "York," built by Davis & Gartner, of York, Penn. sylvania. It was designed by Phineas Davis, an ingenious watchmaker of that borough, under the stimulus of the company's advertisement, and who, probably for the purpose of building it associated himself with Cart-

ner, a machinist of the same place. The weight of the engine, limited by the terms of the specification to 3½ tons, was not exceeded. It had a vertical boiler and was carried on four of the ordinary 302 in. car wheels. The size of its vertical cylinders I find nowhere recorded. After undergoing some modifications by which the functions of the cylinders were transmitted to the driving wheels, and velocity attained through spur gearing, the engine was found capable of conveying 15 tons 15 miles an hour on a level. It was put in regular service between Baltimore and Ellicott's Mills, making the distance of 13 miles in an hour with four cars weighing 18 tons gross. About five miles of this distance had a grade of 17 ft. to the mile. It was found to travel curves of 400 ft. radius with facility, even at 15 miles an hour, and on straight parts of the line sometimes attained a velocity for a short time of 30 miles an hour. The fuel used was anthracite coal, and answered the purpose well, but the boiler was deficient in size. This engine was at once improved upon by the same builders in their engine "Atlantic," which weighed 6½ tons, of which four tons were upon one pair of 36 in. driving wheels. The boiler was much improved. The upright cylinders of 10 x 20 in. were connected to one pair of driving wheels by spur gearing, doubling the velocity. The new feature was introduced of cutting off steam at two-thirds of the stroke. This engine did good work. It was followed from the same shops by the "Indian Chief," soon after ward altered and remodeled as the "Traveller," and then by the "Arabian," which latter machine became the type of the so-called "Grasshopper engine." This engine weighed 7½ tons. The boiler was vertical on the model of that of Peter Cooper with iron tubes. The cylinders, 12 in. x 22 in. were connected through spur gearing, not as in the "Atlantic," directly to the axle of the driving wheel, but to a shaft or axle about 3 ft. in front of the front pair of wheels, parallel therewith and in the same horizontal plane. The ends of this shaft carried cranks which were connected by the usual side rods to cranks on the ends of the driving wheel shafts, thus transmitting the motion to the driving wheels. This arrangement, first introduced into the "Traveller," secured the spur gearing from shocks due to the irregularities of the road and disposed finally of a most troublesome cause of breakages. Chief Engineer Knight in his annual report for 1833 states that the "Atlantic" has run 13,280 miles, burning anthracite coal, of which it had in that distance consumed 190 tons without the failure of a single tube.

The building of these engines was now transferred to the company's shops at Mount Clair, under Phineas Davis as contractor, and the work was there conducted by him until his untimely death by an accident to a new engine he was testing, September 27, 1835. Mr. Davis was succeeded by Gillingham and Winans, who lent their skill to the further perfecting of the machinery and brought these engines to a degree of efficiency which is surprising. So well and so thoroughly was the detail of this engine worked out, and so well adapted was it to hauling heavy loads at slow speeds through curves of the shortest radius, that it has survived to a very recent day. Twenty years ago when the late Benjamin H. Latrobe prepared for the *Railroad Gazette* a very full and complete description of this engine, it is noted by the editor that four of the engines were still in use. Whether any are in service to-day I am not fully informed, but only a few years ago they were used for yard work at Mount Clair and were very efficient.

(TO BE CONTINUED.)

Record of New Track Laid in the United States, Canada, and Mexico, Jan. 1 to July 1, 1892.

The track laid in the United States, Canada and Mexico in the first half of 1892 is reported below, by states and groups of states. A table showing mileage under contract will be published next week, and such corrections of the present total of new track as may be necessary. The present statement, however, is believed to be reasonably accurate. Such errors as there may be are probably omissions that will hardly affect the totals. A few companies which have built new track do not have complete statistics ready until after July 1.

NORTHERN STATES, EAST OF THE MISSISSIPPI.

Maine.	
Portland & Rumford Falls.—Gilbertville west to Rumford Falls.....	15
Track laid.....	15
New Hampshire.	
Brookline & Pepperell.—State line north of Pepperell, Mass., to Brookline.....	4
Concord & Montreal.—End of track laid in 1891, at Randolph, east toward New Berlin.....	6
Track laid.....	10
Massachusetts.	
Brookline & Pepperell.—End of track laid in 1891, near Pepperell, north to state line near Brookline, N. H.....	6
Track laid.....	6
New York.	
Adirondack & St. Lawrence.—End of track laid in 1891, north of Poland to Remsen and on Gang Mill branch, 10.5 miles; north of Remsen to a point above Old Forge and from a point south of Bog River to Tupper Lake, 56.8 miles; Tupper Lake to Malone and branch to Saranac Lake, 32.7 miles; total.....	100.

Dutchess County.—End of track near Hopewell Junction.....		1.
Kings County Elevated.—Schenck avenue to Logan street, Brooklyn.....		6.
Lehigh Valley, on Geneva & Van Ettenville Railroad.—End of track laid in 1891, north of Swartwood to Burdett, 20 miles, and end of track near Lodi north to Geneva, 21 miles; on Rochester & Honeoye Valley branch, end of track north of Rushville to near Rochester, 4.5 miles, a total of.....		45.5
Track laid.....		147.1
New Jersey.		
Central of New Jersey, on Navesink Branch.—Atlantic Highlands east to Highland Beach.....		4
Rockaway Valley.—Mendham east to near Morris town.....		7
Track laid.....		11
Pennsylvania.		
Altoona, Clearfield & Northern.—Wopsononock to Dougherty's.....		5.
Brownstone & Middletown.—Brownstone to Waltonville.....		2.5
Emporium & Rich Valley.—Near Elk Run.....		3.
Erie & Wyoming Valley.—No. 7 Junction to Pittston, Pennsylvania.—On Cambria & Clearfield branch, Kaylor's to Brubaker.....		20.
Pottsville west to Minersville.....		5.
Perry County.—Bloomfield to Green Park.....		7.5
Philadelphia & Reading.—On Bloomsburg Belt branch, near Bloomsburg.....		2.
Pittsburgh & Lake Erie.—On Thompson's Run Coal branch, Ellwood Junction to Coal Mines.....		3.5
Pittsburgh, Shenango & Lake Erie.—Lexington to Conneaut Harbor.....		12.
Williamsport & North Branch.—On Eagle's Mere R. R., Sonestown north to Eagle's Mere.....		8.
Williams Valley.—Brookside west to Lykens.....		12.
Track laid.....		81.5
Ohio.		
Dayton, Lebanon & Cincinnati.—Centerville south to Dods.....		6.
Findlay Belt.—Findlay to Stuartville.....		6.
Salem.—Salem to Washingtonville.....		7.
Pennsylvania.—On Pittsburgh, Ohio Valley & Cincinnati, from end of track near Pultney Bottom, along Ohio River to Powhatan.....		6.
On Toledo, Walhonding Valley & Ohio.—Coshocton north to Walhonding.....		17.
Track laid.....		42.
Indiana.		
Chicago & South Bend.—To factories at South Bend.....		4
Track laid.....		4
Michigan.		
Chicago & West Michigan.—On Traverse City extension from end of track laid in 1891 at Spencer Creek, northeast to Charlevoix.....		37.8
Iron Range & Huron Bay.—Huron Bay south to Summit.....		12.
Manistee & Grand Rapids.—End of track laid in 1891, near Luther, south to C. & W. M. R. R.....		5.
Manistee & N. E.—End of track laid in 1891 near Cedar River, north to Traverse City, 15 miles; and on branches, 3 miles; total.....		18.
Milwaukee, Lake Shore & Western.—Sec. 35, T. 47, R. 40, W. to Sec. 30, T. 47, R. 40, W.....		4.
Sec. 34, T. 47, R. 40, W. to Sec. 22, T. 47, R. 40, W.....		2.
Track laid.....		78.8
SOUTHERN STATES, EAST OF THE MISSISSIPPI.		
Maryland.		
Western Maryland, on Potomac Valley R. R.—Williamsport west to Potomac River.....		14
Track laid.....		14
Virginia.		
Norfolk & Western.—Christiansburg to Kingston Mines.....		3
Track laid.....		3
West Virginia.		
Cairo & Kanawha Valley.—Near Cairo toward Hughes River.....		2.
Huntington & Big Sandy.—Vinson to Ceredo.....		2.2
Norfolk & Western.—On Ohio & West Virginia extension, near Dunlow south to near Pondmouth and on branches.....		67.
West Virginia & Pittsburgh.—Newlon south to Pickens.....		10.
Elk River, south to Erbacon.....		14.
Western Maryland.—On Potomac Valley, end of track at Potomac River west to Cherry Run.....		1.
Track laid.....		96.2
North Carolina.		
Atlantic Coast Line.—A. & R. Junction east to Washington.....		25
End of track near Fayetteville to end of track near Rowland.....		15
Track laid.....		40
South Carolina.		
Atlanta Coast Line.—Latto to near Clio.....		16
Branchville & Bowman.—End of track to Bowman.....		2
Track laid.....		18
Georgia.		
Georgia, Carolina & Northern.—Bryan west to Atlanta city line.....		20
Track laid.....		20
Florida.		
Arcadia, Gulf Coast & Lakeland.—Braidenton south to Sarasota.....		13.
Florida Midland.—Kissimmee to Lake.....		5.
Jacksonville & Mayport.—Arlington to South Jacksonville.....		5.
South Florida.—End of track laid in 1891 near Pemberton Ferry north to Inverness.....		18.
Starke & Sampson City.—Starke to Sampson.....		7.
Track laid.....		43.5

Alabama.		
Gurley's & Paint Rock Valley.—Gurley's up Paint Rock Valley.....		5.
Nashville, Chattanooga & St. Louis.—On Tennessee & Coosa Division, South Gunterville north to Tennessee River.....		3.5
Savannah, Americus & Montgomery, on Montgomery Terminal.—At Montgomery.....		.5
Track laid.....		9.
Tennessee.		
Bristol, Elizabeth & North Carolina.—Bristol south to Bluff City.....		11
Harriman Belt, at Harriman.....		3.
Nashville, Chattanooga & St. Louis.—To Bon Air Coal Mines.....		1
Watauga Valley.—South Watauga to Tannery.....		1.3
Paducah, Tennessee & Alabama.—Vale south to Hollow Rock.....		7
Track laid.....		23.3
Kentucky.		
Newport News & Mississippi Valley, on Ohio Valley.—Gracey southeast to near Hopkinsville.....		8.5
Track laid.....		8.5
SOUTHWESTERN STATES.		
Louisiana.		
East Louisiana.—Chinchuba south to Mandeville.....		5
Kansas City, Watkins & Gulf.—End of track laid in 1891 near Oakdale north to Alexandria.....		38
Louisiana Nickel Plate.—Allen Dale north toward Bellevue.....		3
Track laid.....		46
Missouri.		
Kansas City, Osceola & Southern.—In Kansas City, Mo.....		1.
Kansas City Suburban Belt.—In East Kansas City, St. Louis Merchants Bridge Terminal.—In St. Louis.....		1.5
Missouri Southeastern.—Bloomfield to St. Louis Southwestern R. R. Junction.....		6.
Missouri, Kansas & Texas.—On Missouri, Kansas & Eastern east of Boonville.....		16.
Track laid.....		25.5
Texas.		
Hearne & Brazos Valley.—Mumford to Astin.....		2.
Houston & Texas Central, on Austin & Northwestern.—Fairland west to Llano.....		29.3
Pan-American.—South of Victoria.....		8.
South Galveston & Gulf Shore.—In Galveston.....		4.
Velasco Terminal.—End of track laid in 1891 near Velasco north to Chenango.....		13.
Track laid.....		53.3
Indian Territory.		
Chicago, Rock Island & Pacific.—Mineo south to Duncan.....		57.3
Track laid.....		57.3
Utah.		
Great Salt Lake & Hot Springs.—Bountiful north to Centerville.....		2.5
Rio Grande & Western.—Eureka to Silver City.....		4.
Track laid.....		6.5
NORTHWESTERN STATES.		
Wyoming.		
Burlington & Missouri River.—End of track laid in 1891 at Gillette, west toward Powder River and Buffalo.....		20
Track laid.....		20
Montana.		
Great Northern.—On Pacific Coast extension, end of track laid in 1891 from Kalispel, Mont., west to Idaho state line.....		122.4
On Montana Central branch, Butte to mines and smelters.....		7
Track laid.....		129.4
Idaho.		
Great Northern.—On Pacific Coast extension, west of Kalispel, Mont., to state line on line to Spokane, Wash.....		82.7
Track laid.....		82.7
PACIFIC STATES.		
California.		
San Francisco & North Pacific.—Near Guerneville, west to Russian River.....		1.
San Francisco Belt.—In San Francisco.....		1.
Atchison, Topeka & Santa Fe, on Southern California.—From Mesmer northwest to Santa Monica.....		5.5
Southern Pacific.—Fresno west to Collis, 14; Redlands Junction to Croyton, 7.2; Santa Monica to a new wharf, 2.4; Bakersfield west, 7.5.....		31.1
Track laid.....		38.6
Washington.		
Mason County Central.—Junction to Isabella Lake.....		2.
Great Northern.—End of track at Idaho state line west to Spokane.....		45.2
Northern Pacific.—On Yakima & Pacific Coast R. R. near Dryad west to near Pluvius.....		9.4
Track laid.....		56.6
MEXICO.		
Mexican Central.—End of track laid in 1891, west of Tula, to Pachuca.....		13
Mexican Southern.—End of track laid in 1891, Tecomayaca south toward Oaxaca City to Kilometer 75.....		47
Peninsula of Lower Cal.—Narrows, Lower Cal., to end of grading.....		13
Track laid.....		73
CANADA.		
Manitoba.		
Canadian Pacific.—Near Oxbow southwest to Souris Branch Junction.....		42
Track laid.....		42

Quebec.

Canadian Pacific.—On Montreal & Western R. R., end of track laid in 1891, Ste. Adele north to Ste. Agathe 7
Track laid..... 7

TECHNICAL.

Manufacturing and Business.

The annual meeting of the Harris Palatial Car Co. was held at Portland, Me., June 25, 7,595 shares being represented. The following officers and directors were elected: President, Louie J. Harris, Boston; Treasurer, Charles T. Seaverns, Boston; Secretary, L. M. Harris, Boston; directors, the above officers, together with John L. Rodgers, Boston, and Alfred T. Ackert, New York.

The Waterbury Brass Co., of Waterbury, Conn., is putting up a new iron wire mill, designed by the Berlin Iron Bridge Co. The rolling mill will be 100 ft. x 160 ft., with a wing (to be used for drawing wire) 40 ft. x 230 ft.

The Mason Regulator Co., of Boston, received an order for 500 locomotive reducing valves for the Consolidated Car Heating Co. on June 21. This is the largest single order for reducing valves ever received by the company.

Iron and Steel.

The stockholders of the Bethlehem Iron Co. held their annual meeting June 20 and re-elected the old board of directors and the following officers: President, Robert P. Linderman; Vice-President and General Manager, Robert H. Sayre; Secretary, Abraham S. Schropp; Treasurer, C. O. Brunner; Superintendent and Chief Engineer, John Fritz; Assistant Superintendent, Russel W. Davenport.

New Stations and Shops.

The contract has been let to the Taylor Craig Corporation, of St. Paul, for the erection of a stone trimmed brick passenger station at Minneapolis for the Chicago, St. Paul & Kansas City. This building will be 60 x 25 ft. in dimension and will have a clock tower 14 ft. square and 93 ft. high. The main building will contain a general waiting room, ladies parlor, ticket office and toilet rooms, while the express and baggage rooms will be located in a separate building 24 x 48 ft. in dimension. The work will cost about \$12,000, and is to be completed before Aug. 1. At that time the Chicago Great Western will cease to run passenger trains over the Great Northern between St. Paul and Minneapolis, and will use the tracks of the St. Paul & Northern Pacific for that traffic as well as for freight.

Water Works and Sewerage.

Ridgewood, N. J., a town of nearly 3,000 people, is considering the question of a water supply and sewerage system. Engineers interested in such works who may desire particulars can doubtless obtain them from the Chairman of the Township Committee.

Compressed Air Street Motor.

From an account of the working results of the compressed air street railroad at Berne, Switzerland, given by A. Bertschinger, chief engineer of the line, it would appear that, on the whole, they have been quite satisfactory. The length of line operated is about 1½ miles, built at a total cost, including rolling stock and all necessities, of about \$91,933. The number of passengers carried during the past year was 1,146,532, and the receipts amounted to 118,935 francs, of which about 83 per cent. went to cover the working expenditures. The principal difficulty thus far encountered in operating the road was due to the extremely cold weather during the winter of 1890-91, which caused freezing of the air mains and consequent ice stoppage. The mains were thawed out by means of hot sand. Since then the mains have been covered with a non-conducting covering, and a second air supply main has been laid from the compressor station to the charging station. This new main has a five per cent. grade, in virtue of which the water of condensation drains off rapidly without making traps necessary, and it is thought that in the future, however cold the weather may become, no further trouble from freezing will be experienced. An early extension of the system is in contemplation.

The Baldwin Compound on the Northern Pacific.

The Vauclain compound locomotive built by the Baldwin Locomotive Works for the American Railway Master Mechanics' Association is now being tested by the Northern Pacific, where its performances are regarded as phenomenal. At present it is being used in heavy passenger service, and will later on be tried in freight. After these tests are completed the engine will be taken in turn to the Chicago, Milwaukee & St. Paul, the Chicago, Rock Island & Pacific, the Missouri Pacific and the Texas Pacific.

The South Side Rapid Transit Company's World's Fair Terminal.

The Chicago & South Side Rapid Transit Co. has let contracts for the southern extension to Jackson Park, and the work has been begun. It is expected to have the line completed by Dec. 1. The Illinois Central road will be crossed with a 225 ft. span having a clearance of 21 ft. The bridge will have two plate girders, the posts resting on the curb line of the street below. The foundations of the Sixty-third street line are nearly all in. The structure for this southern extension will be of the lattice girder type.

Intramural Railroads at Jackson Park.

The Western Dummy Company is now receiving bids on the elevated structure and rolling stock for the Intramural Railroad in Jackson Park. This road was described in our issue of May 27, 1892. It is about three miles long between terminals, and has about 5½ miles continuous track.

Launch of the "Texas."

The United States battleship "Texas" was launched at the Norfolk Navy Yard on June 28. The "Texas" is a steel-armored, twin-screw, second-class battleship of 6,335 tons normal displacement. Her principal dimensions are as follows: Length, 290 ft.; extreme breadth, 64 ft. 1 in.; molded depth, 39 ft. 8 in.; mean draft, 22 ft. 6 in. This will be her draft when carrying about 500 tons of coal, with which amount she can steam 1,110 miles at her estimated highest speed of 17 knots an hour, or 8,500 miles at 10 knots.

Bids for the New Croton Dam.

The Aqueduct Commissioners this week opened bids for building the new Croton dam at Cornell, N. Y. There were six bidders, whose figures ranged from \$3,527,640 up to \$5,566,879. Chief Engineer Fteley's estimate of the cost of construction was \$4,574,820. The bids were as follows: The Ryan & McDonald Construction Co., of Baltimore, \$3,527,640; H. H. Brown, of New York, \$3,981,464; Michael S. Coleman, of New York, \$4,253,675; Winston, Crimmins, Washburne & Co., of New York, \$4,708,449; John McQuade and Joseph Moore, of New York, \$5,247,274; William R. Allen & Co., of St. Louis, \$5,566,879. The contract has not been awarded.

THE SCRAP HEAP.

Notes.

The Western New York & Pennsylvania has made a 25-year contract with the Pullman Car Co. for the operation of Pullman cars on all its lines. The present cars are to be replaced by new equipment.

The Coosa tunnel, on the Columbus & Western, is still afloat and it is thought that it will be impassable several weeks. Four men who went into the tunnel with a hose, hoping to extinguish the flames, narrowly escaped death by suffocation.

Foreign Notes.

According to the *Moniteur Industriel*, street railroads are to be established in Smyrna, a company having been formed to carry out the work upon the acquirement of an imperial franchise, which has been asked for.

Projects for four electric street car lines for Vienna have been worked out by a local firm of engineers, with the view of shortly taking in hand the work of construction. As the lines are to be built and worked by private capital, it is thought likely that they will be in operation long before the contemplated rapid transit system, which is to be one of the municipal works of Vienna.

It may be of interest to note that while in 1872 the total length of railroads in Japan amounted to only about 18 miles, there are now over 1,444 miles. Of this length about 540 miles is controlled by the Government; the remainder is in the hands of 11 private companies. The main stations are at the cities Tokio, Kioto, Osaka and Kobe. The two islands Sikok and Kinsin also have railroads. The latest project is for a line between Arvori and Tokio, to be 455 miles long.

Spanish-American Notes.

The new Grand Central Station which it is proposed to build in Buenos Ayres will cost upward of \$1,500,000.

The Uruguayan Congress has passed a bill providing for the entry free of duty of materials and supplies for the guaranteed railroads of that republic.

A second cable is being laid between Santos, Brazil and Montevideo, Uruguay, which, when completed, will give a continuous line of double cable from Pernambuco southward.

A branch of the Tucuman-Cordoba Railroad, Argentine, is being built into the mining district of the Province of Cordoba. Many new mines have been opened in this district, producing argentiferous galena of very high grade.

The Argentine government has just purchased a new armored cruiser from W. Armstrong & Co., of Elswick, England, for \$1,400,000. This vessel was built on speculation, and was originally offered to the government of Chile.

The beauties of state control of railroads are well shown in the recent excitement in Chile, where a crisis was nearly provoked in consequence of the appointment of officers for the management of the controlled roads. The political complexion of the management would influence many thousand votes, which leads very naturally to intense party strife.

The Brazilian scheme of moving the federal capital to some point in the table lands of the state of Goyaz has progressed so far as to send a commission to report upon available sites. Should this project be carried out it would involve the construction of a line of railroad from the present terminus of the Minas Geraes system, and would necessarily lead to a large development of the interior of Brazil.

The São Paulo, Brazil, State Legislature, has passed a bill offering concessions for the construction of two new lines of railroad in that state, one from São Sebastião to Costado de Minas, the other from Cananéia to the Rio Paranapanema. The concessions include a guarantee of interest upon the capital invested and a cash subsidy payable upon the commencement of the work of construction. Considering the general profitability of railroad undertakings in São Paulo and the well known financial integrity of that state, these concessions ought to be readily taken up.

The branch of the Central Argentine Railway from Victoria (on the Tigre line) will be open to traffic to Capello within a few days. This will form a portion of the road by which the Central Argentine will enter Buenos Ayres on its own tracks. The line between Capello and Capilla del Señor is almost completed, after

which only 22 miles remain, between Capilla and the Lujan-Pergamino branch, to complete the direct route between Buenos Ayres and Córdoba. It is expected to have the entire line open within the present year.

The serious difficulties from pestilence, inadequate harbor facilities and general block of business at the Port of Santos, São Paulo, Brazil, has led the Paulista Railroad Co. to petition the general government for a concession to build a branch line to the Port of São Sebastião, together with authority to erect docks and other harbor improvements at that point. São Sebastião lies about 75 miles northeast of Santos, and it is said that a comparatively small expenditure will give it harbor facilities superior to those of the present port, which now enjoys a monopoly of the shipping business of the state.

World's Fair Notes.

The government authorities have awarded the contract for constructing the life saving station authorized to be constructed on the Exposition grounds. The station will cost \$7,878.

Seaboard, a newspaper of New York City will send to the marine section of transportation exhibits about 200 pen engravings of American steam vessels, beginning with the Clermont (1807).

The fly-wheel of the engine in the temporary powerhouse burst one night last week. A fragment of it went through the wall of the Mines and Mining Building, while another fragment fell through the roof of the building, cutting a clean round hole through the roof and floor, and burying itself in the ground.

In the case of the Manufacturers' Building, the completion of which has caused much apprehension, work is advanced with much satisfaction. The iron work is well along, and 15 of the 22 trusses of the central hall are in place. Chief of Construction Burnham ordered the contractors to increase their force of men from 400 to 1,000 to assure the completion of the building in time for the dedicatory ceremonies next October.

The Canadian Pacific Steamship Co. has informed Traffic Manager Jaycox that it will make the following reduced rates for the exposition: On freight from China or Japan to Vancouver, \$10 a ton; on freight consigned on through bills of lading to Chicago, \$16 a ton, all exhibits to be returned free if they have not changed ownership. In passenger fares a half rate will be made for government officials and representatives of the exposition from their respective countries. Visitors from China and Japan will be furnished a round trip ticket to Vancouver, good returning until Dec. 30, 1893, for \$300. This is the regular fare one way.

The test of the passenger boats to be used in the waterways of the grounds next summer, which has proceeded during the week, has developed the fact that no one of the boats so far tested fills all the necessary requirements. The test began last Monday. The course of the boats is about four-fifths of a mile in length. There are three electric boats entered in the contest, but so far two have continually met with mishap. The Columbia launch was started on a ten hours' run. It ran but 12 minutes, long enough to make one round trip over the test course, and then the armature burned out. A similar accident a few days ago happened to this same boat. Another electric launch on trial was charged two days ago and began maneuvering, when its armature burned out. The third electric launch, owned by a New York company, is being made ready for the test. It is said to have behaved well at New York.

Tunnel Under Fourteenth Street, New York.

The New York & New Jersey Terminal Co. has applied to the New York Common Council for an ordinance to permit it to build a tunnel under Fourteenth street, 100 ft. below the surface from the North to the East River, with branches under Hudson street to Chambers street, and thence to Broad and wall streets, and to the East River. Thomas Stearns is Vice-President of the corporation, and William C. Lardy Secretary; Gen. Roy Stone is Chief Engineer. The company's office is at 45 Broadway, New York.

To Prevent Fires in Coal Cargoes.

A device to prevent spontaneous combustion of coal on board ship is referred to in the *Revue Industrielle*. The scheme contemplates the distribution, in a coal cargo, of steel cylinders containing liquid carbonic acid, and closed with fusible plugs of an alloy having its melting point at about 100 deg. C. When the cargo attains this temperature the plugs will fuse, the carbonic acid will expand into the surrounding space.

LOCOMOTIVE BUILDING.

The Long Island Railroad Co. has ordered 10 engines of the Baldwin Locomotive Works, some of which have been built and received, almost identical in design with those used on the "Alley" elevated in Chicago. The difference lies in the diameter of the wheels and the length of the stroke. The engines are Vauclain compounds, with radial stay boilers.

BRIDGE BUILDING.

Boston, Pa.—The contract for erecting a foot and wagon bridge across the Youghiogheny River at Boston, has been awarded to the King Bridge Co., of Cleveland, O., for the iron and steel work.

Cincinnati, O.—A syndicate including A. Johnson, of Cleveland, proposes, it is said, to build an electric line to Price Hill. A viaduct will be necessary over the Mill Creek Valley between Eighth and Liberty streets.

Downington, Pa.—A new overhead bridge will be built by the Pennsylvania Railroad at the Chestnut street crossing in Downington.

Homestead, Pa.—A charter was granted last week to the Homestead & Pittsburgh Bridge Co. to construct a bridge over the Monongahela River, in Allegheny County, at Pittsburgh.

Napa, Cal.—The Board of City Trustees opened bids on June 21 for building a new steel bridge across the river. The bid of the Bay City Iron Works, of San Francisco, \$25,404, was the lowest. The contract will not be awarded until next week.

New York City.—The Park Commissioners received this week five bids, ranging from \$27,970 by Stacy B. Opdyke, of Philadelphia, to \$12,000 by T. & A. Walsh, of 114 Wall street, New York, for the construction of a temporary bridge across the Harlem River, to be used during the building of the new Macomb's Dam Bridge. The lowest bid is \$18,000 less than the estimates.

Point Pleasant, Pa.—The Toledo Bridge Co. has been awarded the contract to erect the Point Pleasant bridge for \$17,000. It will span the Delaware on the site occupied by the wooden structure which was burned down some months ago. The new bridge is to be completed in 14 weeks.

Troutdale, Or.—The County Court has let the contract for building the bridge across the Sandy River, at Troutdale, to Hoffman & Bates, for \$6,230. The piers will be of iron, filled with concrete. The bridge will be combination Pratt trusses, with steel floor beams.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Canada Southern, semi-annual, 1½ per cent. on the capital stock, payable Aug. 1.
Chicago, St. Paul, Minneapolis & Omaha, semi-annual, 3 per cent. on the preferred stock, payable July 20.
Cincinnati, Hamilton & Dayton, quarterly, 1 per cent. on the preferred stock, payable July 5.
Dayton & Michigan, quarterly, 2 per cent. on the preferred stock, payable July 5.
Delaware, Lackawanna & Western, quarterly, 1½ per cent., payable July 20.
Lake Shore & Michigan Southern, semi-annual, 3 per cent. on the capital stock, payable Aug. 1.
Michigan Central, semi-annual, 2 per cent. on the capital stock, payable Aug. 1.
Northern Central, semi-annual, 3 per cent., payable July 15.
Norfolk & Southern, quarterly, 1 per cent., payable July 12.
Norwich & Worcester, semi-annual, 4 per cent. on the preferred stock, payable July 5.
Paterson & Ramapo, semi-annual, 4 per cent. on the capital stock, payable July 1.
Toledo & Ohio Central, quarterly, 1½ per cent. on the preferred stock, payable July 25.
United (N. J.) Ry. & Canal Co., quarterly, 2½ per cent., payable July 11.
Worcester, Nashua & Rochester, semi-annual, 3 per cent., payable July 2.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:
Chicago Junction Railways & Union Stock Yards Co., annual, Jersey City, N. J., July 7.
Galveston, Harrisburg & San Antonio, annual, Houston, Tex., July 5.
Hancock & Calumet, annual, Hancock, Mich., July 12.
Little Falls & Dolgeville, annual, Dolgeville, N. Y., July 20.
Marquette, Houghton & Ontonagon, annual, Marquette, Mich., July 21.
Marquette & Western, annual, Marquette, Mich., July 21.
Mineral Range, annual, Hancock, Mich., July 21.
Wheeling & Lake Erie, special, Toledo, O., July 7.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *American Association of General Baggage Agents* will hold its next annual meeting at Mackinac Island, Mich., July 20.
The *New England Railroad Club* holds regular meetings at the United States Hotel, Beach street, Boston, Mass., on the second Monday of each alternate month, commencing January.
The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.
The *New York Railroad Club* holds regular meetings on the third Thursday in each month, at the rooms of the American Society of Mechanical Engineers, 12 West Thirty-first street, New York City, N. Y.
The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November. By special resolution the next meeting will be held in April.
The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station, at 7:30 p. m.
The *Northwestern Track and Bridge Association* meets on the Friday following the second Wednesday of March, June, September and December, at 2:30 p. m. in the directors' room of the St. Paul Union Station.
The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street, New York.

The *Boston Society of Civil Engineers* holds its regular meetings at the American House, Boston, at 7:30 p. m., on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesday in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1122 Girard street, Philadelphia, on the first and third Saturday of each month. The annual meeting is held on the third Saturday in January. The club stands adjourned during the months of July, August and September.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursday at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, Col., on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms, 112 Mansfield street, Montreal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Association of Civil Engineers of Dallas* meets at 803 Commerce street, Dallas, Tex., on the first Friday of each month at 4 o'clock p. m.

The *Technical Society of the Pacific Coast* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 o'clock p. m. on the first Friday of each month.

The *Tacoma Society of Civil Engineers and Architects* holds regular meetings on the third Friday of each month, in its rooms, 201 and 202 Washington Building, Tacoma, Wash.

The *Engineers and Architects' Club of Louisville* holds regular meetings on the second Thursday of each month, at 8 o'clock p. m., at its rooms in the Norton Building, Louisville, Ky.

The *Association of Engineers of Virginia* holds regular meetings at Roanoke, on the second Saturday in each month, at 8 p. m., except the months of July and August.

American Association for the Advancement of Science.

A meeting of this association will be held at Rochester, N. Y., Aug. 17-23, 1892.

Brotherhood of Railway Carmen.

This association, composed of car inspectors, held its third annual meeting in St. Louis on June 20, 21 and 22; about 100 delegates being present. The membership is now 1,300, and there are 128 lodges. The election of officers resulted as follows: W. S. Messimer, of St. Joseph, Grand Chief; B. F. White, of Temple, Tex., Vice-Grand Chief, and S. Kelleher, Minneapolis, Grand Secretary and Treasurer, and editor of the *Journal of the Brotherhood of Railway Carmen*. The next annual meeting will be at Minneapolis in June, 1894.

Engineers' Club of Philadelphia.

Business meeting was held June 18, President James Christie in the chair, 29 members and visitors present. The tellers reported the election of Messrs. George C. Thayer and William Elton Mott to active membership. The resignation of Prof. L. M. Haupt and Mr. Jesse Garrett was accepted. Upon motion of Mr. John C. Trantwine, Jr., the club appointed Mr. Jos. M. Wilson to aid the committee of the Am. Soc. C. E. by the suggestion of suitable persons to furnish papers for the meeting of the World's Fair Congress Auxiliary of the Chicago Exposition.

A paper by Capt. Smith S. Leach on the Improvements of the Mississippi River was read by the Secretary.

A communication from Mr. Robert L. Holliday, describing a stone box culvert, built in 1832, south of Newcastle, upon the Delaware Division of the P. W. & Balto. R. R., was read, and a sample of 2 in. white pine plank, which formed part of its foundation and had been under water for 60 years, was exhibited in connection therewith. The wood showed an excellent state of preservation.

A section of the first rail used by the Camden & Amboy Railroad was presented by Mr. Rufus Hill, Master Mechanic of the Pavana shops. It is believed to be from the first lot of rails made in this country, and was laid Nov. 12, 1831, at Bordentown, N. J. Designed by Mr. R. L. Stevens. Mr. Wilfred Lewis, upon request, briefly described the recent trip of the American Society of Mechanical Engineers to San Francisco.

Train Dispatchers' Association.

At the annual convention at New Orleans last week the officers elected were as follows: President, H. A. Mace, Dunmore, Pa.; Vice-President, W. W. Alcott, Pine Bluff, Ark.; Secretary-Treasurer, John E. Dowd, Kent, O. An amendment to the constitution was adopted whereby no officer will be eligible to hold office for more than two consecutive terms of one year each.

PERSONAL.

—Dr. William Seward Webb has been elected a director of the Boston & Maine Railroad Company in place of the late J. T. Furber.

—Mr. P. R. Rogers, having resigned as General Passenger Agent of the Louisville, New Orleans & Texas, the office has been abolished.

—Mr. John A. Hall, of Downer's Grove, Ill., editor of *Switchman's Journal*, and a prominent man in the Switchman's Mutual Aid Association, was killed by the cars at East St. Louis on June 22.

—General John B. Echols, Third Vice-President of the Newport News & Mississippi Valley road, has been elected President of the Ohio Valley road, of which he has been Vice-President for several months. Mr. P. G. Kelsey, whom he succeeds, will retire from the road.

—Mr. S. Noonan has been appointed Superintendent of the Manhattan Beach division of the Long Island. Mr. Noonan was at one time Superintendent of the Claremont division of the Boston & Maine, and more recently Division Superintendent of the New York & New England road.

—President Ingalls, of the Cleveland, Cincinnati, Chicago & St. Louis, has recommended to the directors the appointment of Acting Treasurer F. D. Comstock to fill the vacancy caused by the resignation of Treasurer Russell. Mr. Comstock has been paymaster of the Big Four system for a number of years.

—Mr. Charles M. McGhee and Mr. Henry Fink, the Receivers appointed for the East Tennessee, Virginia & Georgia road, have for years been identified with the management of the company—Mr. Fink as Vice-President, and Mr. McGhee as a director and as President of the Memphis & Charleston road. Both have been associated with Gen. Thomas for a very long period. Mr. Fink was Receiver before the reorganization of 1885.

—Mr. Sidney C. Putnam, General Freight Agent of the Old Colony, died last week at his residence, Hyde

Park. His illness began last fall with pneumonia. Mr. Putnam was born in Calais, Vt., in 1823. His first railroad service was on the Central Vermont, and later he entered the service of the old Boston, Hartford & Erie as conductor, afterward becoming freight agent. About 20 years ago he became connected with the Old Colony railroad.

—Mr. William Barclay Parsons, C. E., was severely injured in the accident on the Pennsylvania at Harrisburg, on the morning of the 25th. His injuries are, however, entirely flesh wounds, we believe, consisting of extensive cuts about the head and face. The present indications are that he will make a quick and complete recovery. There are few engineers of his age so widely known, and few with so many warm friends, and they will be glad to know that his injuries are no worse.

—Mr. Jas. L. Taylor who, as announced last week, has resigned as General Passenger Agent of the Richmond & Danville, will enter the service of the Pennsylvania as General Agent of the Passenger Department for Europe. It is understood that Mr. Taylor has made an arrangement for three years, and that he will have his headquarters in London, with duties that will call him to the capitals of Europe.

—Mr. W. A. Turk has succeeded Mr. J. L. Taylor as General Passenger Agent of the Richmond & Danville, with office at Washington, D. C. Mr. S. H. Hardwick, formerly General Passenger Agent of the Central of Georgia, is now Assistant General Passenger Agent of the Richmond & Danville, with office at Atlanta, Ga.

—Mr. H. E. Danz, who has recently been appointed General Freight Agent of the Great Northern, is a very young man to occupy so important position, being only 27 years of age. He began railroading in 1879 as call boy for the Chicago, St. Paul, Minneapolis & Omaha, and filled various positions until 1883, when he entered the service of the St. Paul, Minneapolis & Manitoba as clerk in the general freight office. Since that time he has been continuously employed in the traffic department of that company, now the Great Northern, occupying successively the positions of chief clerk to the general freight agent and chief clerk to the general traffic manager. On Jan. 1, 1891, he was appointed Assistant General Freight Agent, and since December last has been discharging the duties of General Freight Agent.

—Mr. W. K. Muir, a well known Western railroad official, died in Detroit last week. For some time he has been afflicted with rheumatism, and had just returned from a trip to Japan, where he had gone in search of health. The immediate cause of death was inflammation of the brain. Mr. Muir was for several years Assistant Superintendent of the Great Western Railroad of Canada, and was General Manager of the Detroit, Grand Haven & Milwaukee Railroad, and Superintendent of the Michigan Central. At the time of his death he was President and General Manager of the Eureka Steel Works and of the Star Line of Steamers. He leaves an estate valued at over a million of dollars. Mr. Muir was born in Scotland in 1829 and had some service on Scotch and English railroads. In 1852 he was offered a position on the Great Western of Canada and he assisted in opening the first section of that road between Niagara Falls and Hamilton.

—Mr. George O. Somers, recently appointed Assistant General Freight Agent of the Great Northern, began railroad life as operator on the Northern Railway of Canada. He was with that road for three years, and the succeeding three years was out of the railroad service. In 1882 he accepted service with the Canadian Pacific at Winnipeg, resigning the position of Chief Clerk in the passenger department to become Chief Clerk to the General Passenger Agent of the Michigan Central in 1885. From 1886 to 1888 he was Traveling Passenger Agent for the Duluth, South Shore & Atlantic, and at the expiration of that term accepted the position of Chief Clerk in the general passenger department of the Great Northern. After two years service in that capacity he was appointed Chief Clerk to the general traffic manager, and occupied that position when he was promoted to his present position on June 10.

ELECTIONS AND APPOINTMENTS.

American Central.—The stockholders have elected the following directors: Cyrus Balbridge, C. W. Lamson, W. S. Campbell, S. L. Morehead and W. Evenden. Cyrus Balbridge has been elected President and C. W. Lamson Secretary and Treasurer. The office is at Junction City, Ore.

Boston & Maine.—W. G. Bean, of Concord, N. H., has been appointed Assistant Superintendent of the Southern division of the road. He has in the past been connected with the St. Johnsbury & Lake Champlain and the Concord & Montreal roads.

Bristol.—The company has elected as directors P. W. Clement, of Rutland, Vt., E. B. Patterson, Howard Clark, C. M. Wilds, J. J. Kidley, H. G. Smith and E. A. Smith. The directors elected as President, P. W. Clement; Clerk, C. M. Wilds; Treasurer, H. G. Smith. This is a six-mile Vermont road, from New Haven Junction to Bristol.

Carolina Midland.—The stockholders of the company have elected officers as follows: George A. Wagener, President; Mike Brown, Vice-President, and J. C. Keys, Superintendent.

Catonsville Short Line.—The annual meeting of the stockholders of this company was held in Catonsville, Md., June 27. These directors were re-elected: James A. Gary, Henry James, John Gill, Gustave Geiske, J. W. Harvey, T. J. Albert and Dr. C. G. W. Macgill. The board will reorganize by re-electing the present officers: President, James A. Gary; Vice-President, Henry James; Treasurer, John Gill; Secretary, Dr. C. G. W. Macgill.

Central New England & Western.—The road is now fully operated by the Philadelphia & Reading. Appointments have been announced of the following officers, most of whom have been acting in their respective capacities under Receiver J. K. O. Sherwood: Assistant General Manager, I. A. Sweigard; General Traffic Manager, John Taylor; General Freight Agent, B. H. Bail; General Passenger Agent, C. G. Hancock, all with offices at Philadelphia; L. W. Fowler, Superintendent, and C. A. Hayes, Division Freight Agent, with offices in Hartford, Conn. The office of General Freight and Passenger Agent has been abolished.

Charleston, Clendenin & Sutton.—The stockholders met at Charleston, W. Va., June 23, and elected the following board of directors: J. N. Baines, Noyes S. Bur

lew, Charles C. Lewis, Frank W. Abney, Frank Woodman, J. Q. Dickinson, A. L. Ruffner, J. B. Floyd, W. F. Goshorn, W. A. McCorkle, J. M. Payne, C. C. Watts and Joseph Ruffner.

Covington & Ocmulgee.—The following officers were recently elected at Covington, Ga.: Joel Kitchens, President; Harry Camp, Secretary, and Edward Heard, Treasurer.

East Tennessee, Virginia & Georgia.—The Receivers have issued a circular announcing that J. N. Mitchell is appointed Treasurer of the Receivers, with office at Knoxville; William Hawn, Auditor of the Receivers, with office at Knoxville, and H. H. Tatem and Charles H. Davis Assistant Treasurer and Assistant Auditor, respectively, with office at Cincinnati. They will have special charge of the treasury and auditing departments of the Louisville Southern. Separate reports should be made to the Auditor and Assistant Auditor of the traffic and mileage balances that have accrued up to and including July 24 and balances subsequent to that date.

Fulton Street Elevated (Brooklyn).—The following directors have been elected: James D. Frothingham, Wendell Goodwin, James Jourdan, E. A. Abbott, George W. Chauncey, James O. Sheldon, Henry J. Robinson, Edward L. Langford and Walter K. Rossiter.

Kansas City, Wyandotte & Northwestern.—B. P. Waggener, of Atchison, Kan., was on June 25 appointed Receiver, Newman Erb having resigned. Mr. Waggener is President of the road under the reorganization recently effected.

Lake Side (Minn.).—The incorporators are C. H. Graves, Daniel G. Cash, William C. Sargent, George F. Chester and John N. Currie, all of Duluth, Minn.

Mancelona & Northwestern.—The following is a list of the incorporators: William H. Thompson, Clark C. White, Chas. H. Sapp, Phineas Medalia and Huron T. Allerton, all of Mancelona, Mich.

Minneapolis, St. Paul & Sault Ste. Marie.—W. S. Martin, Secretary and Treasurer, has been appointed Assistant General Freight Agent.

Missouri Pacific.—B. H. Payne has been appointed Assistant General Passenger Agent of this company and the St. Louis, Iron Mountain & Northwestern, vice D. B. Caldwell resigned to become Chairman of the Western Passenger Association.

Mohawk & Malone.—The following were named as the directors of this company in the charter filed in New York last week: W. Seward Webb, Henry L. Sprague, Frank G. Smith, Charles H. Burnett, James Eager, William L. Carder, Cassander D. Flagg, J. C. Yager, and C. E. Taylor, all of New York. The company's officers are: President, W. Seward Webb, of New York; Vice-President, James W. Husted, of Peekskill; Treasurer, Frank G. Smith, of New York; Secretary, Charles H. Burnett, of New York.

New York & New England.—At the meeting of Directors June 28 the resignations were accepted of Messrs. J. A. Bostwick, J. L. Macaulay, Henry Hentz and E. V. Carey. Their places were filled by the election of Messrs. Clarence S. Day, William Lummis, Joseph Hentzler, Jr., and Anson P. Flower. Mr. Lummis has been identified with the effort made by President Parsons to establish a voting trust, of which Mr. Day was named as one of the Trustees. Mr. Flower is a member of the firm of R. P. Flower & Co., of New York, and Mr. Hentzler is a brewer of Newark, N. J.

New York, New Haven & Hartford.—The New York, Providence & Boston has been divided into two divisions. J. B. Gardiner, the former Superintendent of the New York, Providence & Boston, is made Superintendent of the Providence Division between New London and Providence, and F. E. Spencer Superintendent of the Worcester Division.

Northern Pacific.—The following changes in arrangement of divisions went into effect on July 1. The Minnesota division, embracing the St. Paul division, the Western Minnesota division, and the Fergus Falls & Black Hills, is in charge of Superintendent A. E. Law, with headquarters at Minneapolis, Minn. The Lake Superior division, including that part of the main line from Duluth to Staples and the Wisconsin division is in charge of Superintendent F. Greene with headquarters at West Superior, Wis.

William Waugh has been appointed Assistant Land Commissioner and General Land Agent with headquarters at St. Paul, Minn., vice George W. Bood, resigned.

Richmond & Danville.—On June 25 the following officers and offices were transferred from Atlanta, Ga., to Washington, D. C., and will hereafter be located at 1300 Pennsylvania avenue (Richmond & Danville Railroad building): W. A. Turk, General Passenger Agent; J. P. Minette, General Purchasing Agent, and C. A. Darlton, Superintendent Telegraph, together with the Car Record and Mileage Department.

W. A. Turk has been appointed General Passenger Agent, with headquarters in Washington, D. C.

San Antonio & Aransas Pass.—Several new appointments were made on June 20 by the new President, D. B. Robinson. Charles D. Dorman, of New York, was appointed Auditor, to succeed H. Michaelson; W. H. Field, of Iowa, was appointed Cashier, to succeed C. S. Wheeling. The office of General Superintendent, held by George L. Sands, was abolished, and F. E. Nelson was appointed Superintendent of Transportation, with headquarters in San Antonio, Tex. A. W. Houston has been appointed general counsel of the company, to succeed W. Aubrey. William Berry has been appointed Superintendent of the road department, and will have charge of the maintenance of way bridges, buildings and water service, with headquarters at Yoakum, Tex.

Southwestern (Florida).—The company has been chartered by Dexter Hunter, J. C. Greeley, D. N. Reynolds, of Jacksonville, Fla.; W. J. Wilson and A. Budington, of Green Cove Springs, Fla.

Titusville & Indian River.—The company has been chartered by Warren C. Spencer, of New York; B. K. Barr and Albert W. Webber, of Jacksonville, Fla.

Toledo & Astoria.—H. B. Wall, J. S. Gill, George B. Hazen and W. L. Boise, of Portland, Or., filed a charter for this road in Oregon last week.

RAILROAD CONSTRUCTION. Incorporations, Surveys, Etc.

Grandack & St. Lawrence.—The opening of the road north of Poland, N. Y., for regular passenger travel times postponed, has now been announced

for July 2. At present trains will run as far as Fulton Chain Station (Old Forge), 58 miles north of Herkimer, and 42 from Poland. Sleeping cars will leave the Grand Central Station, New York, at 9:15 p. m., and arrive at Fulton Chain about 8 o'clock the following morning. The officers expect to have passenger trains running on the entire line to Malone, 173 miles from Herkimer, in August.

The new track laid on the road this year to July 1 amounts to an even 100 miles. Thirty-five miles of track was laid in 1891 north of Remsen and at Tupper Lake. The track laid this year is from Remsen, 10 miles south, and north from the end of track laid last year to a point above Old Forge, completing a continuous section of track from Herkimer to that point; also, 33 miles on the section between Tupper Lake and Malone. The unfinished portion of the tracklaying is on the section between Old Forge and Lake Lila, 31 miles, and between Rainbow and Loon Lake, 14 miles, on the section north of Tupper Lake. The only grading not now entirely completed is on the middle section of the road north of the Moose River, which is being built by the Enterprise Contract Co. This work has been considerably delayed this spring on account of the unfavorable weather.

Alabama Grand Trunk.—The difficulty over the right of way which has delayed the tracklaying north of Montgomery, Ala., will, it is expected, be settled in a few weeks, so that this work may be resumed early in July, and the line completed to the Tallapoosa River. The first section of the road for about 12 or 15 miles between Montgomery and the Tallapoosa River was graded in April and it was intended to complete the tracklaying for this distance at once so that the new road might be used as a belt line, but the construction work was stopped by an injunction issued on account of a right of way dispute. H. G. McCall, of Montgomery, is President.

Altoona Short Line.—The profiles are now nearly completed for the main line of this road through Bedford County, Pa. The company was incorporated the latter part of December to build a road from Everett to Riddleburg and Ore Hill, Pa., a distance including branches of about 40 miles. S. L. Langdon, of Bullitt Building, Philadelphia, is President.

American Central.—Under this name C. Balbridge and C. W. Lawson, of Junction City, Or., organized a company to build a line, as they outline the route, "from San Francisco to Boise City, Idaho, and also a branch line from some point in California to Klamath Falls, Klamath County, Or." The press report naively adds: "The directors decided to issue first-mortgage bonds to the amount of \$20,000 per mile and \$5,000,000 of second-mortgage bonds."

Asheville & Craggy Mountain.—There is some prospect of work being resumed soon on an extension from the present end of track about 2½ miles from the city of Asheville, N. C., to the summit of Sunset Mountain. About 1.8 miles of road will have to be built from the present terminus. The top of Sunset Mountain is 850 ft. above the city. W. B. Gurney, of Asheville, N. C., is President.

Atlanta Belt.—A plan for the construction of an eight-mile belt line at Atlanta, Ga., is reported to be under consideration by the Georgia, Carolina & Northern. The line now only reaches the city limits and further progress has been hindered by the injunction secured by the Georgia road, which prevents the new road crossing its right of way. It is intended to reach the centre of the city and the Union station over the Western & Atlantic tracks. The belt line is to be built around a section of the city to connect the two roads.

Baltimore & Ohio.—The track is being laid on the extension from Uniontown, Pa., to Smithfield, and it is expected to run trains on that part of the line in July. The force of men will then be put on the line on the southern section from Morgantown to Point Marion, to have it graded by the time the line north of Point Marion is ready for the rails, on which portion the work is now going on vigorously. It is said that the contract for the bridge across Cheat River will soon be let.

Branchville & Bowman.—About 1¼ miles of the line has been built this year in Orangeburg County, leaving about one mile of road still to be built to complete the line from Branchville to Bowman, S. C., 10½ miles. The construction on the extension has been extremely slow. Nine and one-half miles of the road from Branchville were completed in June, 1891, when the line was located to Bowman, and grading was begun on the extension to that point last October. An extension is proposed beyond Bowman, but the location is not yet made, and it is not likely that any work will be done this season beyond building into Bowman. S. Dibble, of Orangeburg, S. C., is president.

Brockville, Westport & Sault Ste. Marie.—A delegation waited on the Dominion Government last week asking a bonus to enable the company to extend the line from Westport to Palmer's Rapids, Ont., a distance of 80 miles, to connect with the Irondele, Bancroft & Ottawa.

Brookline & Pepperell.—About two-thirds of the ballasting on this road is now completed, and it will probably be opened for traffic between West Groton, Mass., and Brookline, N. H., 15½ miles, by August. All the track has now been laid, 10 miles of it having been completed this year. The contractors are F. M. Mead & Co., Exchange Building, Boston. Franklin Worcester, of Hollis, N. H., is President.

Bristol, Elizabethtown & North Carolina.—Eleven miles of track has been laid on this road on the main line south of Bristol, Tenn. The work has been resumed with vigor recently, and the officers of the company state that the main line will be completed to Elizabethtown by July 20, completing the road for a distance of 21½ miles.

Burlington & Missouri River.—Tracklaying west from Gillette, Wyo., toward Sheridan and the Montana line, stopped ten days ago by a strike of tracklayers, has been resumed, and is going ahead at the rate of a mile a day. The contractors now have employed 1,300 teams and 3,500 men. It is proposed to increase the force when the weather becomes entirely settled.

Cairo & Kanwha Valley.—The construction of this road south of Cairo, W. Va., near Ritchie, is still going on, but the work is being completed very slowly, as the company has undertaken to build the road with its own forces. About two miles of the line is reported to have been built this year, making the length of the road 12 miles. At present an additional three miles is being built near the Hughes River. The southern terminus of the road is to be at Grantsville, about 20 miles beyond the Hughes River. H. S. Wilson, of Parkersburg, W. Va., is President.

Cambria & Clearfield.—The Pennsylvania is constructing many new branches in the anthracite and bituminous coal regions. The most active work at present being carried on is on the branches of this road, reports a local paper. It adds that the main line, when its contemplated extensions shall have been completed, will extend from Cresson by way of Chest Creek to La Jose and to Maghee's, to connect with the Cush Creek division. The Cush Creek branch, also, it is stated, will be extended to Cherry Tree to connect with the Susquehanna division now graded, making a continuous line from Kaylor's, via Chest Creek Junction, Carrolltown, the head waters of the Susquehanna, the new mining town of Spangler, Walnut Run, Moss Creek, Garman's Mills to Cherry Tree. The road is now operated from Cresson to La Jose, and from Mehaffey to the head waters of Cush Creek. At Mehaffey the road connects with the Beech Creek.

Canadian Pacific.—About 42 miles of track has been laid this year on the line south of Oxbow, Man., to the coal fields in Manitoba reached by the Souris branch. The new track begins at a point about three miles west of Oxbow at Moose Mountain Creek. About 60 miles of branches of the western division in Manitoba are now being graded and it is expected to have the track on all the lines completed this summer. The lines are from Deloraine to Napinka, Man., 18 miles; Nesbitt to Souris, 18½ miles, and 33 miles on the Pipestone branch west of Monteth. The Calgary & Edmonton is also being extended south to Fort McLeod and tracklaying will soon begin south of Mosquito Creek, the present terminus, a point about 56 miles south of Calgary, Alberta. On the Montreal & Western seven miles of track have been built this year north of St. Adele, Que., and will soon be opened for traffic. Both of these lines are operated by the Canadian Pacific.

Charleston, Clendennin & Sutton.—The new directors, given in another column, are to elect officers this week. They report that work on the construction of the road is progressing satisfactorily and they expect to have regular trains running between Charleston and Clendennin, W. Va., the present year.

Chicago, Rock Island & Pacific.—It is announced that the Texas extension, which, as reported last week, is now completed to Duncan, Ind. Ter., will be opened for traffic to that point 57 miles from Chickasha on July 15.

Cleveland, Cincinnati, Chicago & St. Louis.—The second track has been extended to Edgemont, 10¼ miles west of Cincinnati. A force of 200 men, it is reported, completed the grading and tracklaying for the new second track between Elmwood and Edgemont in three days.

Coal River.—This company was chartered in West Virginia June 23, with the principal office at Charleston, W. Va. Capital, \$1,000,000. The route is not given. The incorporators are T. L. Brown, R. T. Oney, Joseph Ruffner, Roman Pickens, Fontaine Brown, William Peyton and Peter Fontaine, all of Charleston, W. Va.

Duluth & Iron Range.—The continued wet weather has interfered with the work of constructing the branch to the Mesaba iron range. The work is now being pushed and the line will be completed about Sept. 1.

Duluth, Pierre & Black Hills.—Contracts were let at Pierre, S. D., on June 22, according to a press dispatch, for the completion of the grading. Work has been delayed for several months waiting for the Northern Pacific to complete its part of the contract. Everything has now been arranged for the speedy completion of the road and the grading will be finished this fall. The work to be completed is on the line between Faulkton & Blunt, S. D., near Pierre.

Duluth, Mesaba & Northern.—Grading is being pushed now that the high water has receded. The rails are nearly all on the ground, and tracklaying on the main line north to the Mesaba iron range will be commenced in about two weeks. The line is now being built from Stony Brook on the Mississippi River north to the new town of Grant, Minn., 50 miles, and a branch is being built from a point in section 22 to the Biwabik mines, the terminus being at the town of Merritt 13 miles from the main line. The contractors for the grading are Grant, Foley Bros. & Guthrie, of St. Paul, who are to have all the work now under contract completed by July 15.

Emporium & Rich Valley.—It is reported to us that three miles of this road has been built this year from Elk Run, Pa. About one mile additional will be completed during the summer or fall. The line is being built by P. Fitzpatrick. Josiah Howard, of Emporium, Pa., is President.

Great Northern.—The track laid this year on the Pacific Coast extension of this road aggregates 25½ miles, and comprises the section from Kallispell, Mont., which was the end of the track on Jan. 1, to Spokane, Wash., which was reached by the tracklayers early in June. The new mileage is divided as follows: In Montana, 122 miles; in Idaho, 83 miles, and in Washington, 45 miles. Much of the grading has been completed west of Spokane to the Columbia River, but no track has yet been laid on this section, and work has not yet been resumed through Spokane. There has been built on the extension up to the present time 511 miles of track, of which 99 miles was built in 1890, from Pacific Junction on the main line west, and 102 in 1891 from the previous end of track, completing the line into Kallispell. The following approximate distances on the line were reported to us recently, and are reasonably correct, though the point at which the line will cross the Columbia River was probably not then known: Pacific Junction to Kallispell, 251 miles; Kallispell to the Columbia River 425 miles; from the crossing of the river to the Cascade Mountains, 56 miles, and west of the mountains to Puget Sound, 77 miles. Shepard, Siems & Co., of St. Paul, have the contract for the work to the Columbia River, and Shepard, Henry & Co., of Seattle (in which Henry & Balch, of Minneapolis, have an interest), has the work from the summit of the Cascade Mountains to the Sound. E. H. Beckler, of Helena, is the Chief Engineer of the extension.

It is stated in a local paper that 30 teams are at work on the grading of the branch from St. Hilaire, N. D., to Thief River Falls, and it is expected to have the work finished by Aug. 15.

Greenfield & Northern.—The company is arranging to begin work soon on an extension from Mt. Vernon southeast to Aurora, Mo., a distance of 10 miles, connecting with the St. Louis & San Francisco. The building of the line will give a new connection with the Kansas City, Ft. Scott & Memphis, with which a junction is made at Mt. Vernon.

Goodyear, Neillville & Northern.—The company proposes to build this year most of the line from McKenna to Williston, Wis., a distance of 12 miles. Several other extensions have been surveyed, but it is probable this line will be the first to be completed, and will be undertaken before the proposed extension of the main line to Neillville. C. A. Goodyear, of Tomah, Wis., is President.

Gurleys & Paint Rock Valley.—Five miles of track is reported as laid on this line to July 1 from Gurleys, Ala., up the Paint Rock Valley. The first 30 miles of the line up the Paint Rock Valley is now being built. The contractors, as already reported, are Allen, Mosely & Co., of Rocky Mount, Va. The entire length of the projected line is 70 miles from Deposit on the Tennessee River to Winchester, Tenn.

Hearne & Brazos Valley.—Two miles of the extension beyond Mumford toward the Brazos River has been completed and track laid for two miles to Astin. It is proposed to build this year to Stone City, Tex., five miles beyond Mumford. The grading of tracklaying is being done by the company. T. C. Westbrook, of Hearne, is President.

Illinois Central.—The company has signed the ordinance passed by the Chicago City Council last month, of which mention was made in the *Railroad Gazette* June 3. The World's Fair managers have contributed \$200,000 and the Chicago Street Railway Co. \$100,000 toward the building of the elevated roadbed. The average height above the present grade will be about 8 ft. Plans and specifications are now being drawn up and contracts will be let in a short time. The work will be carried on as fast as possible.

Iron Range & Huron Bay.—The company has already completed 12 miles of track on the north end of its line from Huron Bay south to Summit, Mich. This leaves 23 miles of track to be laid to complete the line of Champion, Mich., when this work is resumed, probably in July. M. Lally, of Detroit, is the contractor for the grading which is now in progress, and T. H. Hamilton, of Toledo, is building the ore dock on Huron Bay. E. H. Miller, of Arvon, Mich., is Chief Engineer.

Jacksonville, St. Augustine & Halifax River.—Matthew Hays has a grading contract on the extension from Daytona south to New Smyrna, Fla. T. L. Marquis, of Bartow, also has contract for part of the work. It is reported that the road will be continued from New Smyrna via Titusville to Rockledge.

Kanawha & Michigan.—Shump & Glenn, of Huntington, W. Va., have secured the contract for grading 10 miles on the extension to the Gauley River. Gen. J. C. Casement, of Charleston, W. Va., has the contract for building the 32 miles of the extension.

Lake Shore & Michigan Southern.—Work is going on, it is reported, on the new line between Hillsdale, Mich., and Elkhart, Ind.

Lake Side (Minn.).—Articles of incorporation were filed in Minnesota last week. The company is to construct a street line between Lakeside and Duluth, and the incorporators are C. H. Graves, W. C. Sargent and other directors of the Duluth & Northeastern Terminal Co.

Lehigh Valley.—An extension of the Loyalsock road, a proprietary line of this company, from Harvey's Lake to Bowman's Creek, Pa., a distance of six miles, is under contract, the work being let to Sayre & McDonald, of Harvey's Lake, Pa.

Little Falls & Dolgeville.—Tracklaying has just commenced on this line at Little Falls, N. Y., as stated last week, and it is proposed to complete the first five miles northeast of that town by July 15. This will leave 10 miles of track to build to reach the terminus at Dolgeville.

Los Angeles Terminal.—The company began operating on June 13 the old San Gabriel Valley road of 17 miles, it having been widened to a standard gauge line. It is now operating 73 miles of road and has more daily trains in and out of Los Angeles than either the Southern Pacific or the Atchison, Topeka & Santa Fe, the number being 50. The Southern Pacific is next with 36 trains. On July 1 the new bathing pavilion at Long Beach is to be opened and as this road is pleasantly located, with seven miles along the coast, a large travel during the summer is expected.

Louisiana Nickel Plate.—The company has completed this year three miles of road north of Allen Dale, La., building the line with its own forces by day's labor. Four miles additional is now being built toward Bellevue which is about 12 miles north of Allen Dale. W. G. Wadley, of Houghton, La., is General Manager.

Macon, Dublin & Savannah.—T. B. Redmond, of Chattanooga, is building the two miles of new road into Macon, Ga., referred to last week. The extension includes the building of a bridge across the Ocmulgee River, at Macon, and about two miles of track. The contract for the bridge, which is to consist of two Howe truss spans 160 ft. each, has been let to Shailer & Schnigau, of Chicago. The work will be completed in about 60 days.

Mancelona & Northwestern.—The company has been organized in Michigan under the act providing for the incorporation of steam roads, not the general railroad laws. The road is to extend from Mancelona to the Cedar River Valley, a distance of about eight miles. The names and addresses of the directors are given in another column.

Manistee & Grand Rapids.—The end of track on this line is now at the junction with the Chicago & West Michigan road south of Luther, Mich., about four miles of the track having been laid this year. No work is going on at present, but it is intended to extend the line from Oak Park to Manistee River, five miles, and from the Chicago & West Michigan crossing for Grand Rapids.

Mason County Central.—The road has been extended this year about two miles to Isabella Lake, Wash. This leaves about eight miles of road to be built to connect at Summit with the Gray's Harbor branch of the Northern Pacific. This will complete the system as outlined last August, when the present company was organized by Allen C. Mason, of Tacoma.

Mexican Southern.—The track has been extended this year from Tecamavaca, Mex., south for 75 kilometres, or 47 miles, making 299 kilometres of the line constructed to this date from the city of Puebla toward Oaxaca City. This leaves 68 kilometres of track to build to complete the line to the city of Oaxaca, 90 miles from Tecamavaca. Read, Campbell & Co., Ltd., of the City of Mexico are the contractors.

Milwaukee & Superior.—The name of the Milwaukee, Menominee Falls & Western has been changed to the above. There is some likelihood of a further extension of the line being built this year from Sussex west of Milwaukee to North Lake, Wis., a distance of about eight miles.

Minneapolis & St. Louis.—The second track to Lake Minnetonka, Minn., was finished last week and a new timetable has gone into effect.

Mobile, Natchez & Columbia.—The Governor of Mississippi issued his proclamation on June 24 incorporating this railroad company.

Montreal & Western.—H. J. Beemer, contractor for this road, says the first 30 miles of the road from St. Jerome north to St. Agathe, Que., now completed, will be opened the first week in July, the Canadian Pacific operating the line. Thirty-four miles of the road are graded and ballasted. The road is under contract to St. Jovite, 52 miles north of St. Jerome.

Nashville, Chattanooga & St. Louis.—President Thomas has promised to begin work on the extension of the Tennessee & Coosa road immediately if the citizens of Huntsville, Ala., will secure free right of way over the old route of the road, as projected before it was acquired by this company.

New Roads.—The Chamber of Commerce, of Raleigh, N. C., proposes the building of a road from Raleigh to Averasboro, the head of navigation on the Cape Fear River. The estimated cost is \$156,000.

New York Bay Extension.—The construction of this branch of the Long Island has been suspended since our last report, published May 20, but this is understood to be only temporary. The road is a branch of the Long Island, and is to extend from Hempstead to Valley Stream, 6½ miles. The Hawman Bros., of Reading, Pa., are the contractors.

Norfolk & Western.—The track laid since Jan. 1 on the main line and on various branches of the Ohio & West Virginia extension aggregates more than 60 miles. The total track now laid on the line is 142 miles, leaving 50 miles remaining to be built, the entire length of the extension being 192 miles. Seventy-five miles of the track was laid last year. The officers state that the extension will certainly be completed in October and the work may be finished in September.

Northern Pacific.—The only track laid by this company in 1892 is 9.39 miles in Washington, on the Yakima & Pacific Coast branch. The new track is from a point west of Chehalis, near Dryad, to near Pluvius, leaving 28 miles to be built to complete the line to the western terminus, at South Bend, on the coast. The road is being built by Griggs & Huestis, of Tacoma, Wash.

Ohio Valley.—The track on the Hopkinsville extension has now been laid from Gracey southeast for about 8 miles to a point 1½ miles from Hopkinsville where connection is to be made with the Louisville & Nashville.

Ottawa & Gatineau Valley.—Work is now being pushed on the fourth ten mile section, as stated last week, and it is expected cars will be running the full 40 miles to beyond Wakefield by September. The company intends beginning the fifth section this fall. The work is being done by day's labor. The iron bridge over the Stag River on the fourth section is completed.

Pan American.—Captain John Barrett, who has the contract for building the track on this road, says that he has now laid eight miles of rails from Victoria, Tex., and as soon as 10 miles is finished the grading will commence again and be pushed rapidly south.

Pennsylvania.—Active work is going on all along the new line extending from Allen's Lane on the Chestnut Hill branch to the Trenton cut-off. The abutments on both sides of Germantown avenue have been completed, and a considerable part of the other work is completed.

Peoria & Eastern.—About four miles of new road will probably be built this year west of Danville, Ill., a new location having been made on account of a proposed change of grades.

Peterborough, Sudbury & Sault Ste. Marie.—Surveying parties have started out to locate this projected line west and north of Peterborough, Ont.

Philadelphia & Northern.—The directors have decided at a special meeting to increase its capital stock from \$600,000 to \$1,000,000. The route of the line, which is a branch of the Philadelphia & Reading, is from Wistar Station, on the Germantown Road, to the North Pennsylvania, and the right of way has now been secured the entire distance. The work of construction will soon be begun.

Philadelphia & Reading.—Engineers of the company are now running a line through Trimble's Gap, in Chester Valley, Pa., a local paper reports, adding that during last week they surveyed a course northward to Chester Springs, Pa., and are now directing their line southward, toward West Chester, near Philadelphia.

Pine Bluff, Monroe & New Orleans.—An extension of the line will probably be built this year northeast to Bayou Meta, Ark., a distance of 6½ miles. A. V. Stafford, of Pine Bluff, is General Manager.

Pittsburgh, Ohio Valley & Cincinnati.—The track on the road is laid from Bellaire, O., which is the northern terminus of the road, to Powhatan, a distance of 16 miles. The present end of the track at Powhatan will probably remain the southern terminus for some time to come, as it is not now contemplated to extend the line beyond that place. The road is not open for regular traffic, but will be operated when opened by the River Division of the Cleveland & Pittsburgh, under the management of the Pennsylvania Company.

Port Arthur, Duluth & Western.—The contractors expect to commence the tracklaying in a few weeks on the line to the International Boundary. Fifteen miles of road remains to be built to complete the line from the present terminus at Sandy Lake to Gunflint Lake at the Minnesota State Line. The contractors, Middleton & Conmee, of Port Arthur, who are building the line, expect to resume work in May, but they have been delayed. It is pretty certain, however, that the road will be completed to Gunflint Lake by January.

Providence & Springfield.—The company, it is reported, has sold \$750,000 worth of bonds to replace \$500,000 worth of seven per cent. bonds previously sold, and to finish its line from Pascoag to East Thompson, Conn., which will make a through line to Springfield, Mass., for the New York & New England, the lessee of the road.

Quebec, Montmorency & Charlevoix.—An extension of this line is proposed from Ste. Anne de Beaupré, 21 miles from Quebec, the present terminus of the road to Cape Tourmente, Que., 10 miles. W. R. Russell, Quebec, Superintendent.

Rockaway Valley.—The tracklaying on the extension east of Mendham will probably be completed to Morristown, N. J., this week, as already stated, though it is not expected that regular trains will be running over the extension until September. It is now proposed to continue the line through Morristown, east of the Delaware, Lackawanna & Western track, to Morris Plains, N. J., about two miles, upon which it is proposed to lay track next month.

St. Louis, Cape Girardeau & Fort Smith.—It is intended to complete this year the branch from Puxico, Mo., southeast to Poplar Bluff, Mo., on the St. Louis, Iron Mountain & Southern, a distance of about 20 miles. The line has already been surveyed.

St. Louis, Kennett & Southern.—An extension of this line is being built under the name of the Pemiscot railroad from Kennett, its present southern terminus west to Caruthersville on the Mississippi River, a distance of about 24 miles.

San Francisco & North Pacific.—About 75 men are working at present on the extension of the Fulton & Guerneville branch through Sonoma County west of Guerneville, and about one mile of the grading and tracklaying has been completed. The new line will be only three miles long, beginning at a point 1.07 miles west of Guerneville, the present terminus of the branch, and reaching a tract of redwood timber about four miles west of the town. The grading is side hill work and the maximum grade is 75 ft. to the mile, and the maximum curvature is 14 degrees. The combination bridge over the Russian River will consist of two spans of 160 ft. and 242 ft., with a trestle approach 800 ft. long. The bridge and trestle work is being built by the Pacific Bridge Co., of San Francisco, but the grading and tracklaying will be done by the company. Frank H. Zook, of San Francisco, is the Chief Engineer.

Southern Arkansas.—About 10 miles of the line through Calhoun County, Ark., south of Dry Run, Ark., on the St. Louis Southwestern, now being built by the Southern Land & Lumber Co., whose headquarters are at Dry Run. Part of the line is reported to be already completed. The southern terminus is to be at Hampton, in Calhoun County, about 20 miles south of Dry Run. L. B. Conroy is Secretary of the company.

Southwestern (Florida).—This company was chartered in Florida last week by Dexter Hunter, of Jacksonville, Fla., and others. It proposes building a road from Green Cove Springs southwest about 50 miles to Micanopy, a distance of 60 miles. The capital stock is \$170,000.

Titusville & Indian River.—The route of this road, recently chartered in Florida, is to be from Titusville, on Indian River, the terminus of the Jacksonville, Tampa & Key West, to Cape Florida, with a branch to Cape Canaveral and New Smyrna, Fla. The capital stock is \$2,000,000.

Toledo & Astoria.—Articles of incorporation were filed in Oregon last week. The capital stock is \$600,000. The projectors state that their object is to construct a road from Astoria, Wash., to deep water on the Columbia River, in Washington. The principal office is to be at Portland, Or.

Toledo, Columbus & Cincinnati.—The reports are revived that the extension from Kenton to Columbus, O., surveyed some time ago, will be built this summer, but there does not seem to be any sufficient authority for the statement.

Toledo, Walbonding Valley & Ohio.—The track will be laid by the end of this week from the junction with the P. C. & St. L., at Coshocton, O., northwardly, to a point six miles beyond Warsaw, O., near Walbonding, or a total distance from Coshocton of 17 miles. The grading of the entire line between Coshocton and Loudonville, 46 miles, is substantially finished; but on account of recent floods the masonry on some of the bridges is delayed, and, consequently, the erection of the superstructures is not progressing as rapidly as desirable. It is hoped that in the early part of September the entire line between Coshocton and Loudonville will be ready for traffic.

Tredegar Mineral.—An extension of the line is being built from the present terminus to Jacksonville, Ala., and the work will probably be completed by July 15. This is the only construction work undertaken this year by the company, and no track has been laid except on this line, which is about one mile long. Other extensions are proposed in addition to the line to Iron Mountain, 6½ miles, but the branches have not been located, and the particulars of the lines cannot be given at present. George H. Montgomery, of Jacksonville, Ala., is Chief Engineer.

Trinidad & San Luis Valley.—Engineer John Mahoa, of Trinidad, Col., has started for Costilla Pass, from the summit of which he will begin the survey of this road. Several lines from that place to the Stonewall country will be run. It is thought that a grade of two per cent. can be secured. The road is to be built by J. R. De Remer under an agreement with the Board of Trade of Trinidad.

Union Pacific.—The Catskill Branch will probably be extended about 10 miles from its present terminus near Trinidad, Col., to a lumbering camp.

Virginia, Shenandoah & Western.—The proposed road from Shenandoah west to Harrisonburg, Va., on the Baltimore & Ohio, will be built under the charter of this company. The line will be 25 miles long, connecting with the Norfolk & Western at Shenandoah. The road is proposed by the Shenandoah Land & Improvement Co., but as yet no very definite arrangements have been made to complete the line, although it has been projected over a year, and locating surveys were made last fall.

Watauga Valley.—The only construction work completed on this road this year has been the building of a branch 1½ miles long from South Watauga, Tenn., to a tannery. The grading has been about completed on five miles of the line beyond Watauga, the work being practically finished for probably three-fourths of the distance. The total length of the line so far located is 22 miles from South Watauga to manganese iron ore property embracing nearly 5,000 acres of land located in the Cranberry Iron region. George C. Potts, of South Watauga, is President, and J. W. Caldwell is Secretary.

West Virginia & Pittsburgh.—The grading on the Pickens extension is finished and only two miles of

track remains to be laid. The entire road between Newlon and Pickens, W. Va., a distance of 10 miles, will be completed by Aug. 1. Eighteen miles of track on the Gauley extension has been laid south of the Elk River to near Erbacon, and the work is being pushed to completion as fast as possible. It is expected that the line will be fully completed by the middle of August, from Flatwoods on the main line, southwest to Camden-on-Gauley, a distance of 40 miles. J. A. Fickinger, of Weston, W. Va., is Chief Engineer.

GENERAL RAILROAD NEWS.

Central of New Jersey.—The earnings and expenses of the road are reported by the Port Reading Railroad Co., lessee, as follows:

Month of May.	1892.	1891.	Inc. or Dec.
Gross earn.	\$1,160,601	\$1,148,950	I. \$11,651
Oper. exp.	678,937	656,209	I. 22,728
Net earn.	\$481,664	\$492,741	D. \$11,077
Five months ending May 31.			
Gross earn.	\$5,546,114	\$5,254,825	I. \$291,289
Oper. exp.	3,277,098	3,112,748	I. 164,350
Net earn.	\$2,269,016	\$2,142,077	I. \$126,939

Charleston, Cincinnati & Chicago (in Tennessee).—The Tennessee courts have confirmed the sale of the railroad lines in that state belonging to this company for \$200,000 in the interest of some associated bondholders. The lines in South and North Carolina, now operated by the South Carolina road, have not yet been foreclosed.

Cleveland, Lorain & Wheeling.—Judge J. A. Tyler, General Counsel of the road, denies the recent reports that he concluded a sale of the controlling stock in New York. He says he has never been given any authority to dispose of the interest of either Mr. Perkins or of the Selah Chamberlain estate. Despite this emphatic statement, it is still repeated that the control of the property has changed hands.

Dover & Winnipisaukee.—The stockholders met in Dover, N. H., June 24, and voted to sell the road to the Boston & Maine on the basis of exchange of four shares of their stock for three of Boston & Maine. The capital stock is \$400,000. The road extends from Dover to Alton Bay, 29 miles, and is leased to the Boston & Maine.

East Tennessee, Virginia & Georgia.—Judge H. F. Jackson, United States Circuit Judge, this week appointed Charles M. McGhee and Henry Fink, Receivers of this road and its leased lines. The appointment was made upon a bill filed in the Circuit Court at Knoxville by Samuel Thomas, of New York. General Thomas says that the appointment of the Receivers was made necessary by the numerous changes of management of the Richmond Terminal and Richmond & Danville in the last six months. He says that the East Tennessee property needs no reorganization aside from adjustment of some of the later issues of bonds, mainly held by friends of the company, who can be consulted and some arrangement made without reorganization. Sufficient means are at hand to pay the accruing interest on all classes of bonds, and the court will be requested to authorize such payment. General Thomas says that the company, the court permitting, will meet all its obligations that are due on July 1. The July payments for the entire system aggregate about \$650,000.

Fall Brook.—Commencing July 1, the system of railroads controlled by the Fall Brook Coal Co., extending from Lyons, N. Y., to Williamsport, Pa., will be known as the Fall Brook Railway Co. A circular issued from the President's office reads: This company, formerly known as the "Corning, Cowanesque & Antrim Railway Co.," will operate the lines of the Syracuse, Geneva & Corning Railway and the Pine Creek Railway Co.'s line heretofore operated by the "Fall Brook route."

Kansas City Elevated.—The reorganization of the Interstate Rapid Transit Road was completed last week, the new name being as above. The motive power will be changed from steam to electricity, but the property will not come into the possession of the new company until September.

Lehigh Valley.—The result of the operation of the Philadelphia & Reading Railroad Co., lessee of the Lehigh Valley for the month of April, 1892, is as follows:

	1892.	1891.	Inc. or Dec.
Receipts.....	\$1,306,930	\$1,186,147	I. \$120,783
Expenses.....	963,948	908,420	D. 55,528
Earnings.....	\$342,982	\$277,727	I. \$65,255
Five months ending April 30.			
Receipts.....	\$6,954,006	\$6,081,814	I. \$872,192
Expenses.....	5,658,323	5,250,501	I. 407,822
Earnings.....	\$1,295,683	\$831,313	I. \$464,370

Louisville Southern.—Following the appointment at Knoxville of a Receiver for the East Tennessee, Virginia & Georgia Railroad, Samuel Thomas has filed suit in the United States Court at Louisville asking the appointment for a Receiver for this road, leased by the East Tennessee.

New York Central & Hudson River.—The earnings and expenses for the quarter ending June 30 were as follows, the figures for 1892 being partly estimated:

	1892.	1891.	Inc. or Dec.
Gross earn.	\$10,979,250	\$10,387,349	I. \$591,901
Oper. exp.	7,518,721	6,871,909	I. 646,812
Net earn.	\$3,460,529	\$3,515,440	D. \$54,911
Fixed charges.....	2,508,287	2,500,714	I. 7,573
Profit.....	\$952,242	\$1,014,726	D. \$62,484
Dividend.....	1,117,853	894,283	I. 223,570
Surplus.....	def. \$165,611	\$120,342	\$285,953
For the year ending June 30 the earnings were:			
Gross earn.	\$45,537,428	\$37,902,115	I. \$7,635,313
Oper. exp.	31,067,523	25,370,852	I. 5,696,671
Net earn.	\$14,469,905	\$12,531,263	I. \$1,938,642
Fixed charges.....	9,919,783	8,881,904	I. 1,037,879
Profit.....	\$4,550,122	\$3,649,359	I. \$900,763
Dividend.....	4,471,415	3,577,132	I. 894,283
Surplus.....	\$78,707	\$72,167	I. \$6,540

Mohawk & Malone.—A joint agreement of consolidation of the Herkimer, Newport & Poland, the Herkimer, New York & Poland Extension and the St. Lawrence & Adirondack, forming the Mohawk & Malone, was filed with the Secretary of State at Albany, June 23. Several other joint agreements have been filed by these

roads under different names since Dr. W. S. Webb began building his Adirondack railroad, these charters covering part of these lines.

New York, Lake Erie & Western.—The following statement shows the earnings for May and the eight months to May 30:

Month of May.	1892.	1891.	Inc. or Dec.
Gross earnings.....	\$2,417,565	\$2,449,436	I. \$31,871
Oper. expen.	1,721,564	1,573,282	I. 148,282
Less proportions due to leased lines.....	896,091	876,154	I. 19,937
Net earnings.....	\$669,976	\$679,540	I. \$9,564
Eight months, Oct. 1 to May 31:			
Gross earnings.....	\$20,250,205	\$18,806,227	I. \$1,443,978
Oper. expenses.....	13,549,789	12,553,381	I. 996,408
Less proportions due to leased lines.....	6,400,416	\$6,252,898	I. \$147,518
Net earnings.....	\$1,731,472	\$1,656,001	I. 75,471

Pennsylvania.—The statement of the business of all lines east of Pittsburgh and Erie for May, 1892, as compared with the same month in 1891, shows an increase in gross earnings of \$493,993; an increase in expenses of \$347,242; a decrease in net earnings of \$53,249. The five months of 1892, as compared with the same period of 1891, show an increase in gross earnings of \$1,067,861; an increase in expenses of \$1,024,370; an increase in net earnings of \$43,491. All lines west of Pittsburgh and Erie for May, 1892, as compared with the same month in 1891, show an increase in gross earnings of \$288,195; an increase in expenses of \$542,130; a decrease in net earnings of \$253,935. The five months of 1892, as compared with the same period of 1891, show an increase in gross earnings of \$2,235,530; an increase in expenses of \$1,970,131; an increase in net earnings of \$265,399.

Philadelphia & Reading.—The following statement shows the earnings of the railroad for May, 1892, as compared with 1891:

	1892.	1891.	Inc. or Dec.
Gross receipts.....	\$1,829,309	\$1,779,222	I. \$50,087
Oper. expen.	1,018,377	985,591	I. 32,786
Profit in operating.....	\$810,932	\$793,631	I. \$17,301
Other receipts.....	27,373	14,483	I. 12,890
Profit for month.....	\$838,305	\$808,114	I. \$30,191
Expen. for perm. imp.	\$8,114	\$20,855	D. \$12,741
One-twelfth fixed charges.	825,000	611,769	I. 213,231
Surplus.....	\$63,114	\$63,224	I. \$110
Surplus.....	\$205,091	\$175,490	I. \$29,601

Poughkeepsie Bridge Co.—The sale of the Poughkeepsie bridge under the foreclosure proceedings is to take place this week, and the new company will probably be formally transferred to the Philadelphia & Reading early in July. The Reorganization Committee is arranging to have the transfer made as soon as the sale is completed. All the bonds, with the exception of \$100,000, have been deposited under the reorganization plan.

Richmond & West Point Terminal.—Drexel, Morgan & Co., who were asked a month ago by a committee of security holders to suggest a plan for the reorganization of this company have declined to undertake the task. Their reasons are given in the following letter dated June 28, to W. E. Strong, Chairman of that committee: "We have made a careful investigation of the affairs of the Richmond & West Point Terminal Railway & Warehouse Co., and its allied corporations, and Mr. Spencer has, on our behalf, made a personal inspection of the entire system. We have reached the conclusion that a reorganization is feasible on a basis of equity to all concerned, one that we should be prepared to undertake, and one which, in our opinion, would place your property on a sound financial basis. The unparalleled complications and difficulties which must be met in this connection make it necessary, we need scarcely add, that we should, as your representatives and as far as possible, be protected against any single interest which might, for personal or other reason desire to thwart the successful carrying out of such reorganization. With this in mind, we deemed it essential before any action on our part that a majority of each class of stock and bonds of Richmond & West Point Terminal Railway & Warehouse Co. be deposited with us, for the purpose of reorganization, and that all litigation should be put under our control, and persons of our own selection should be substituted for the Receivers now in possession of the properties. Therefore, upon learning of the appointment of receivers of the Richmond & Danville property by the United States Court, we applied to Mr. W. P. Clyde to know whether, in case we undertook the reorganization, the suit under his control would be transferred to us, and the present Receivers resign in favor of Mr. Spencer, stating to him that, in our opinion, such a course was essential. He declines to give us any assurance, and our conversation with him leads us to doubt his loyalty to any reorganization plan whatever, although he, as one of your committee, signed the request to us to undertake the same. As, in our opinion, it is essential to the success of any plan that during the reorganization the properties involved should be under our control, as already mentioned, and as the position taken by Mr. Clyde makes this impossible, we are obliged reluctantly to decline the invitation to undertake the reorganization."

St. Louis, Alton & Springfield.—A decree for the sale of this road has been granted in Springfield, Ill., under foreclosure proceedings by the Mercantile Trust Co. and the Atlantic Trust Co., of New York.

St. Louis & San Francisco.—The Massachusetts Supreme Court has refused to restrain the company from issuing \$50,000,000 in bonds, holding that the first preferred stockholders must seek protection of their rights in the Courts of Missouri. The decision was in the suit brought by D. P. Kimball and other preferred stockholders opposed to the agreement with the Atchison.

Terre Haute & Peoria.—A special meeting of the stockholders was held at Decatur, Ill., June 23. An issue of \$2,500,000 of bonds for funding the old bonds of the company and for equipment of the road was authorized. According to the press dispatches, the board of directors was authorized to lease the road, but no more definite statement can be obtained.

Valley (Ohio).—Some of the first mortgage bondholders of the company are co-operating with the view, it is understood, of resisting the attempt of the Baltimore & Ohio to reduce the interest upon their bonds.

They believe that if the property had been operated independently of the Baltimore & Ohio it would not have defaulted upon its interest.

TRAFFIC.

Chicago Traffic Matters.

CHICAGO, June 29, 1892.

The reduction in the provision and live stock rate has not as yet produced any appreciable increase in the tonnage of the Lake Shore.

Auditor McCain of the Interstate Commerce Commission has been scoring the Central Traffic Association for crowding the time limit in the recent reduction in east-bound rates. He states that the notice was not received by him until the afternoon of June 13, and was effective June 16, consequently he holds that the rates were used illegally, the required three days' notice not having been given. Probably he would not have taken notice of this case but for the fact that he believes that the roads are getting habitually lax in their observance of the law in this respect.

The Commissioners of the Western Traffic Association have called another meeting for July 7 to hear any matters that may be brought to their attention.

No notice has been given by the Atchison of intention to put in effect the proposed reduction in second class passenger rates to Pacific coast points, but there is a suspicion that they will be adopted within a few weeks.

The recent storms have been the cause of much trouble to nearly all the river lines, and it has been with great difficulty that the through trains have been kept moving. Many of the branch lines are tied up and freight traffic is practically at a standstill.

The Big Four lines propose a rate of \$22.50 from St. Louis (including \$2 admission free) as a basis rate for the meeting of the National Educational Association at New York.

Traffic Notes.

Seven carloads of hogs recently reached Buffalo in 40 hours from Kansas City.

The Housatonic has discontinued its through freight rates to New York by way of Wilson's Point.

The Pennsylvania Co. is now carrying about 500 cars of ore daily from Lake Erie ports to Pittsburgh and the region roundabout.

The Atchison, Topeka & Santa Fé has reduced freight rates between Denver and the City of Mexico, the new (first-class) rate being \$2.50, which is 76 cents less than the old.

The Northern Pacific has reduced the rates on lumber and shingles from the state of Washington to all Eastern points. The rate to Minnesota Transfer from the Pacific Coast is now about 50 cents. Twenty carloads of shingles were recently sent from Ballard, Wash., in a single train to St. Paul.

The Texas Railroad Commission has notified the railroads that it intends to make a freight classification covering all freight. Most of the tariffs heretofore issued have been commodity tariffs, though many of them were quite sweeping. It is now about a year since this commission began making rates.

From June 1 to 18, inclusive, the freight received at Denver from the East was divided as follows among the several lines: Atchison, 180 cars, or 34.22 per cent.; Union Pacific, 196 cars, or 37.07 per cent.; Rock Island, 33 cars, or 6.27 per cent.; Burlington, 70 cars, or 13.31 per cent.; Missouri Pacific, 48 cars, or 9.13 per cent.

The Empire State Express now has five cars each way between New York and Utica, one car running through between New York and Clayton. The eastbound Empire State Express makes the same time as the west-bound between Buffalo and Albany, the 35 minutes' difference between the two schedules being all south of Albany.

The Missouri & Kansas Car Service Association is now in operation. Mr. A. P. Wilder, of Kansas City, being the Manager. The roads interested are the Missouri Pacific; Atchison, Topeka & Santa Fé; Chicago, Rock Island & Pacific; St. Louis & San Francisco; Kansas City, Fort Scott & Memphis; Kansas City, Clinton & Springfield; Union Pacific; Kansas City, Osceola & Southern, and the Missouri Pacific. The association has jurisdiction at all junction points on these roads.

The Interstate Commerce Commission, which apparently has received complaint against the Grand Trunk, is inquiring of that road and its connections concerning the difference between domestic and export rates on freight to Boston and other points on the Atlantic seaboard. There is considerable speculation concerning this action of the Commission, for the reason that the recent decision of the United States Court in a case against the Wabash (by Judge Allen, at Springfield, Ill., Feb. 29), held that the United States had no control over rates on freight shipped into or through a foreign country.

The percentages of traffic carried by the Southwestern Missouri River lines for the month of March are as follows:

	Tonnage.	Revenue.
Santa Fe.....	23.9	28.4
Alton.....	10.2	11.3
Burlington.....	19.0	18.1
St. Paul.....	5.5	7.0
Rock Island.....	9.3	9.5
Maple Leaf.....	5.0	5.2
Wabash.....	6.8	6.9
Missouri Pacific.....	20.3	15.6

The total tonnage was 230,739, against 261,401 in February and 306,759 tons in January. Of the March tonnage 92,830 was westbound and 176,905 eastbound. Revenue for March was \$925,154, against \$870,796 in February and \$913,912 in January.

The Boston papers announce a new through passenger train between Boston and Philadelphia over the New York & New England, Central New England & Western, the Poughkeepsie Bridge, and connecting lines, ending with the Philadelphia & Reading. The train is to run through in about 12 hours each way, leaving Boston at 9:30 a. m. and Philadelphia at 10 a. m. It seems that this train will travel over the New York & New England only for that portion of the road east of Hartford, but it is announced that a freight traffic agreement between this road and the Philadelphia & Reading, lately signed, provides that 50 per cent. of what business can be secured for this through line shall be transferred at Hopewell, which is the southern terminus of the new Dutchess County Railroad, which connects the New York & New England with the Poughkeepsie Bridge. The passenger train heretofore running between Boston and Philadelphia over the Poughkeepsie Bridge is a night train and goes via Northampton and the Boston & Maine.

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The WESTINGHOUSE AUTOMATIC BRAKE is now in use on 24,000 engines and 325,000 cars. This includes (with plain brakes) 232,000 freight cars, which is about 23 PER CENT. of the Entire Freight Car Equipment of this country, and about 80 per cent. of these are engaged in interstate traffic, affording the opportunity of controlling the speed of trains by their use on railways over which they may pass. Orders have been received for 173,000 of the Improved Quick-Action Brakes since December, 1887.

The best results are obtained in freight train braking from having all the cars in a train fitted with power brakes, but several years' experience has proven conclusively that brakes can be successfully and profitably used on freight trains where but a portion of the cars are so equipped. Below is a graphical illustration of the progress made in the application of the Automatic Brake to freight cars since its inception.

Year.	No. per year.	Grand total.
1881	105	105
1882	1,085	1,190
1883	4,966	6,156
1884	15,051	21,207
1885	10,410	31,617
1886	8,946	40,563
1887	9,281	49,844
1888	27,696	77,540
1889	26,065	103,605
1890	50,502	154,107
1891	39,061	193,168

193,168 freight cars fitted with the Westinghouse Automatic Brake, which is nearly 20 per cent. of the Entire Freight Car Equipment of this country.

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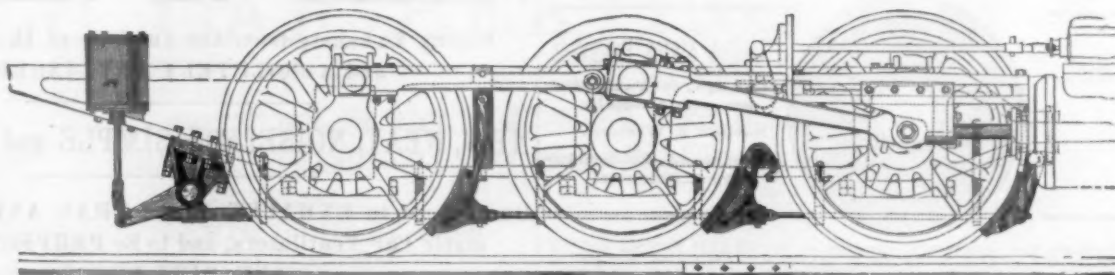
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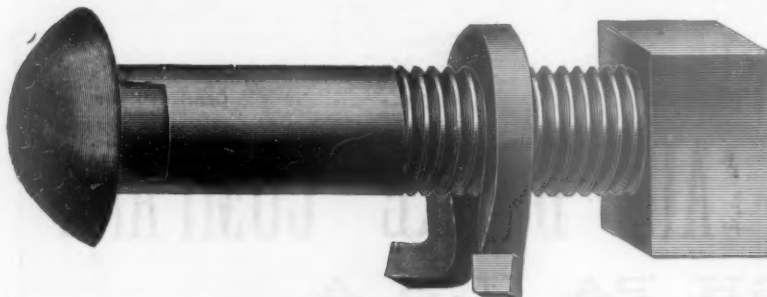
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Standard Outside Equalized Pressure Brake, for two or more pairs of Drivers furnished to operate with either STEAM AIR or VACUUM.

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Manufactured under D. O. Ward's Patents by the
STANDARD NUT LOCK CO.,
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 SAMPLES FREE.

This nut lock is presented on its merits as the best and cheapest device for securing track joints.

It is a torsional loop made of good quality of tempered spring steel, having horizontally inclined foot pieces, which are curved inward, thereby greatly increasing the spring resistance and acting simultaneously: rests upon the base of angle bar, or underlying rail base in case of fish plate, preventing the loop portion from rotating and hammering down thread of bolt.

The nut lock for $\frac{1}{4}$ bolt made of $\frac{1}{4}$ in. square steel, standard pattern, yields a tension of 4,300 lbs. on the bolt, which is sufficient to reduce the wear of the bearing surfaces of the angle bar on the rails, imparting, as it does, a uniform bearing the entire length of the bar.

The "Standard" Nut Lock has sufficient elasticity to maintain a tight joint, which cannot be truthfully said of many light-weight single coil washers.

The "Standard" Nut Lock is, in its superficial form, similar to an annular coil twisted out of plain, i. e., the curved shoulders or ends of the loop proper are spread in the usual manner of spring coils, at which bearing points the locking friction is equal to that of the best single coil washer, and added to this it is terminated in inwardly curved extensions, which must apparently furnish additional short leverage spring force of a torsional character.

Distinctive Merits of the "Standard" Nut Lock, Condensed:

Fixedness of position—cannot rotate and hammer down threads of bolt.

Cannot get one end 'nto elongated slot of angle-bar.

Unlike any permanently placed, double washer, the Standard is interchangeable regardless of distance between bolts.

Cannot be put on wrong side out, as the outward projection of the foot pieces would prevent the nut being turned up.

Has more spring power directly under the nut than any two ordinary coil nut locks. Being fixed in position, it offers double the locking friction of nut locks, which when in their dead "set" condition turn back with nut by the vibrative effect of passing train.

The "Standard" Nut Lock embodies the old principle of spring power improved by overcoming the objection to the double washer or nut lock, and covering the weak points of the single coil washer.

THE STANDARD COMBINATION TIE PLATE AND BRACE

POSSESSES THE FOLLOWING MERITS:

1. It prevents absolutely the canting of the rail into the tie, thereby greatly increasing the life of the tie.
2. It prevents the rails from spreading or canting over and wearing one side only.
3. The combination of the brace and plate obviates the necessity of spiking the rail and brace separately, thereby saving two spikes and securing the service of the inside spike for holding the rail; it also prevents the rail from working up and down, and laterally, thus making it impossible to wear the neck of the spike.
4. The plate and brace being made of malleable iron, is practically indestructible.

The tie plate and brace is especially useful for curves and guard rails, and also on bridges, whether the rail is laid on ties or on stringers. A tie plate without a brace will not save the head of the spike. A brace without a tie plate will not save the tie, and in a short time the rail will wear into the tie.

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 Classes of Work.

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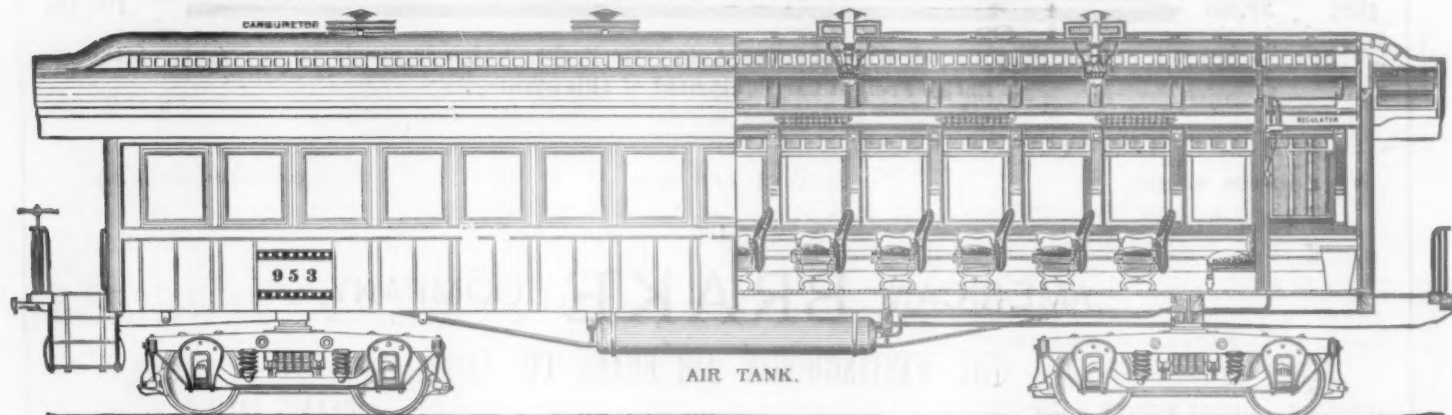
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ONE HEATING in the Coldest Climate keeps a train thoroughly comfortable for two hours, and a pressure of steam afterward, of five minutes in each hour, is sufficient to maintain a uniform temperature of 70 degrees. No overheating and no cold cars. In case of accident there is absolutely NO DANGER OF FIRE, or injury from SCALDING, by escape of steam.

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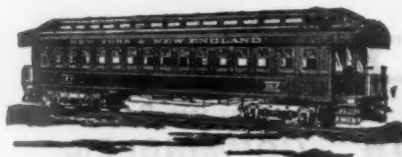
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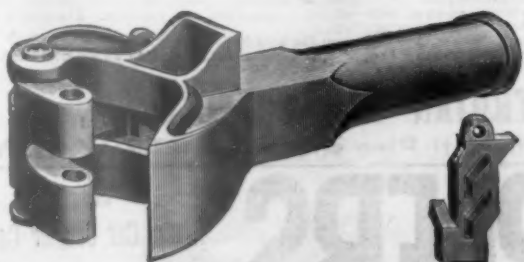
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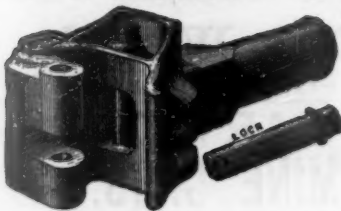
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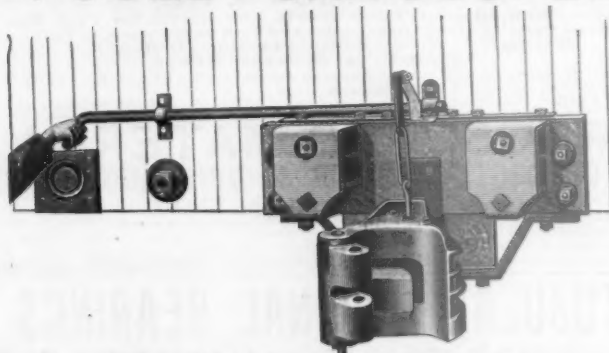
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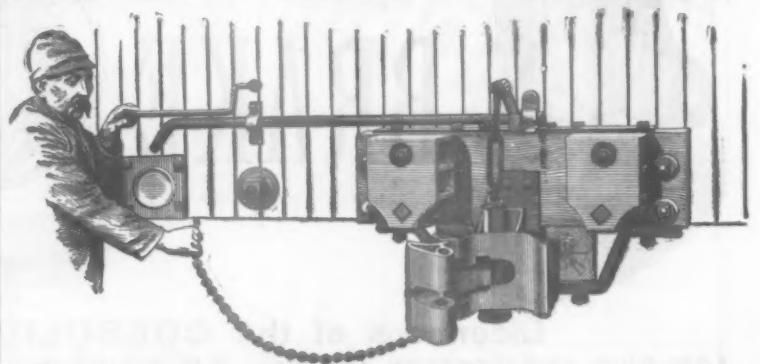
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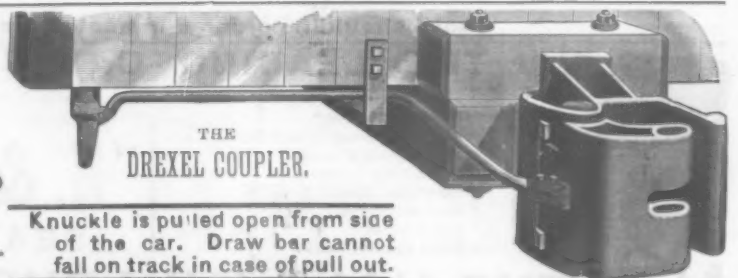
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Knuckle is pulled open from side of the car. Draw bar cannot fall on track in case of pull out.

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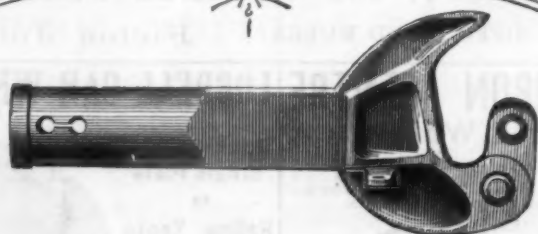


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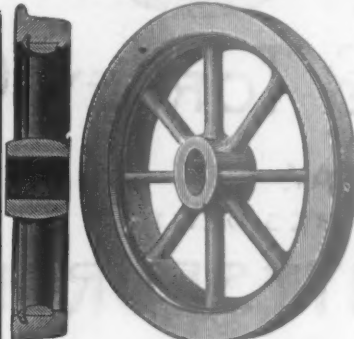
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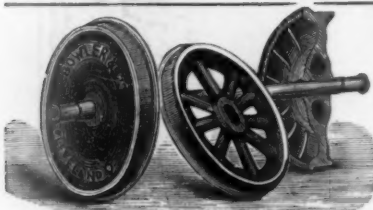
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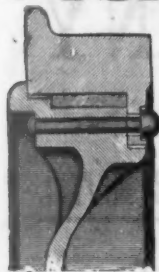
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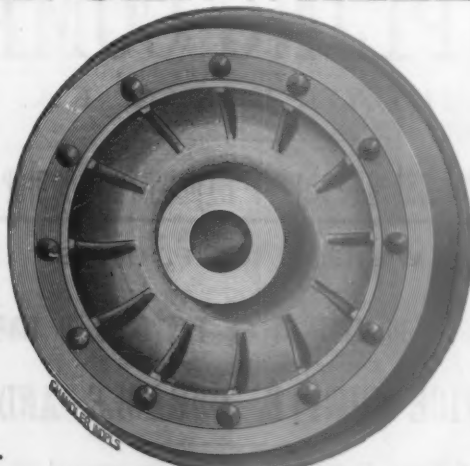
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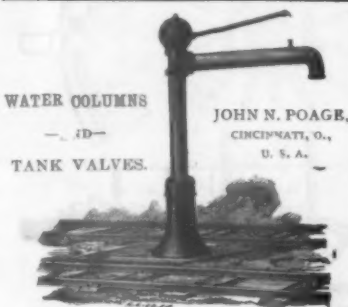
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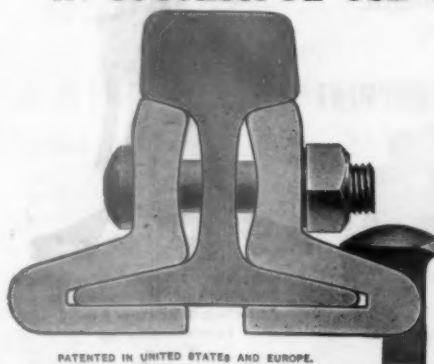
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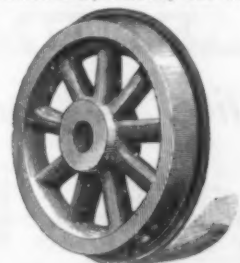
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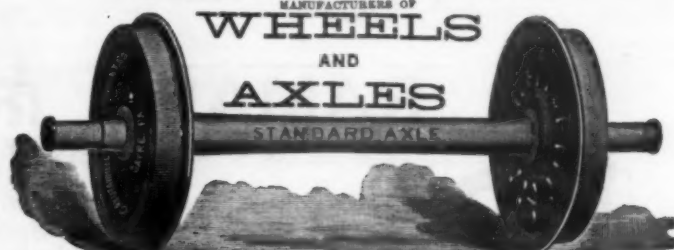
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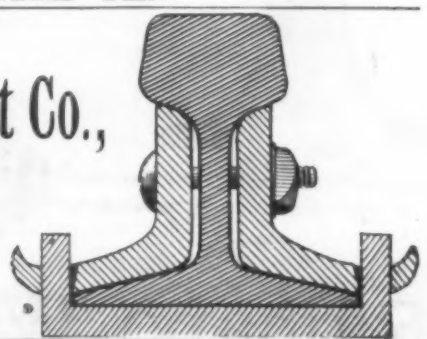
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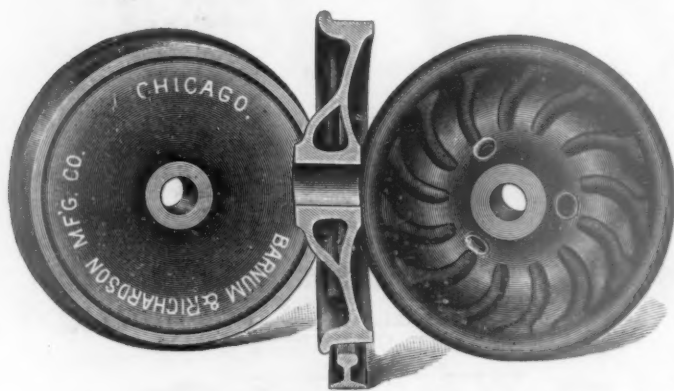
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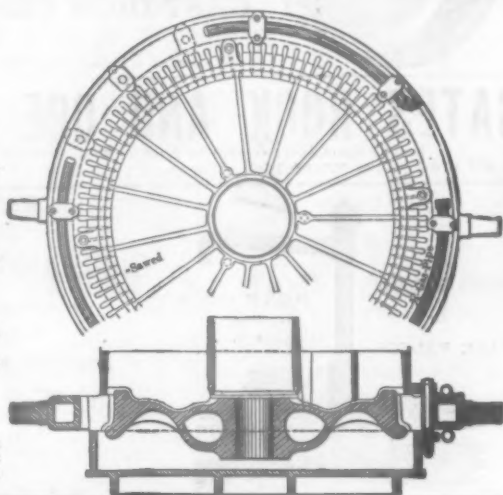
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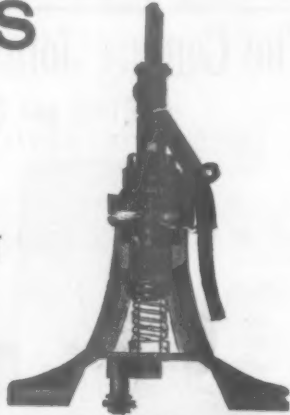
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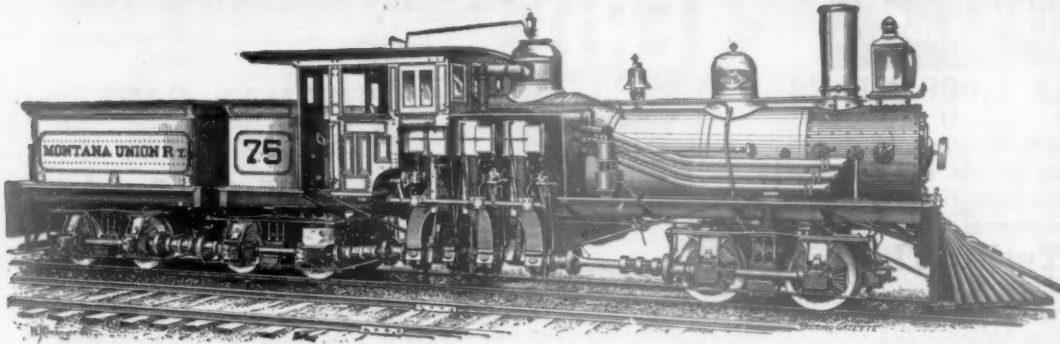
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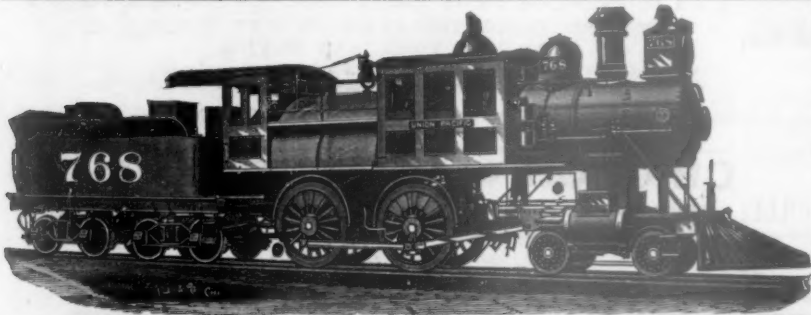
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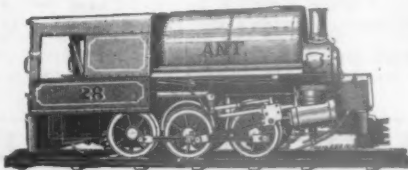
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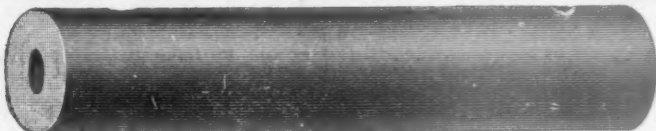
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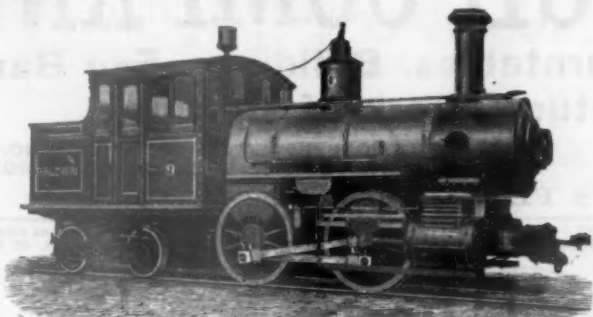
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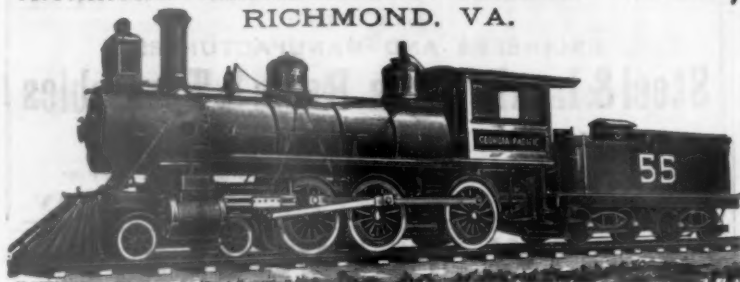
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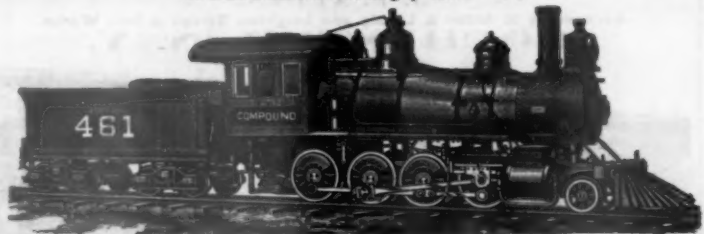
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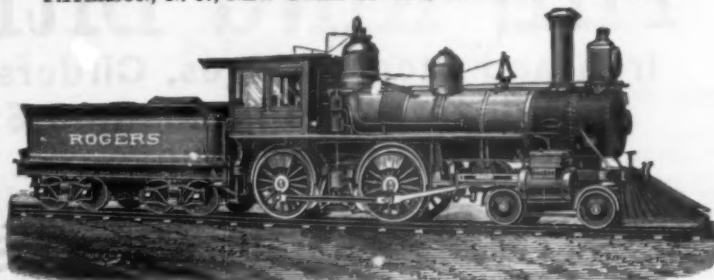
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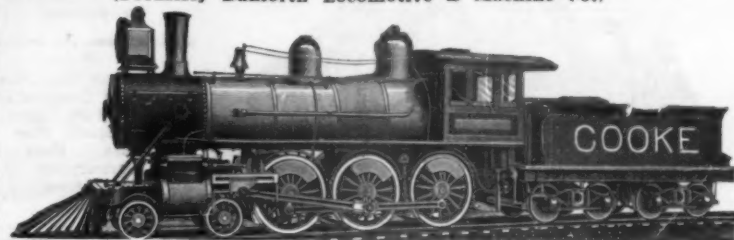
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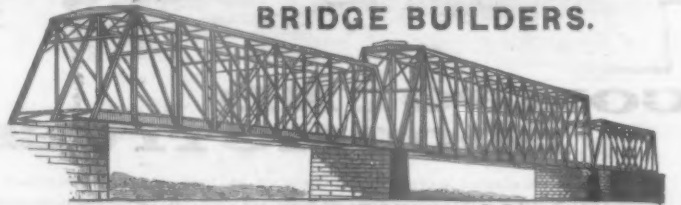
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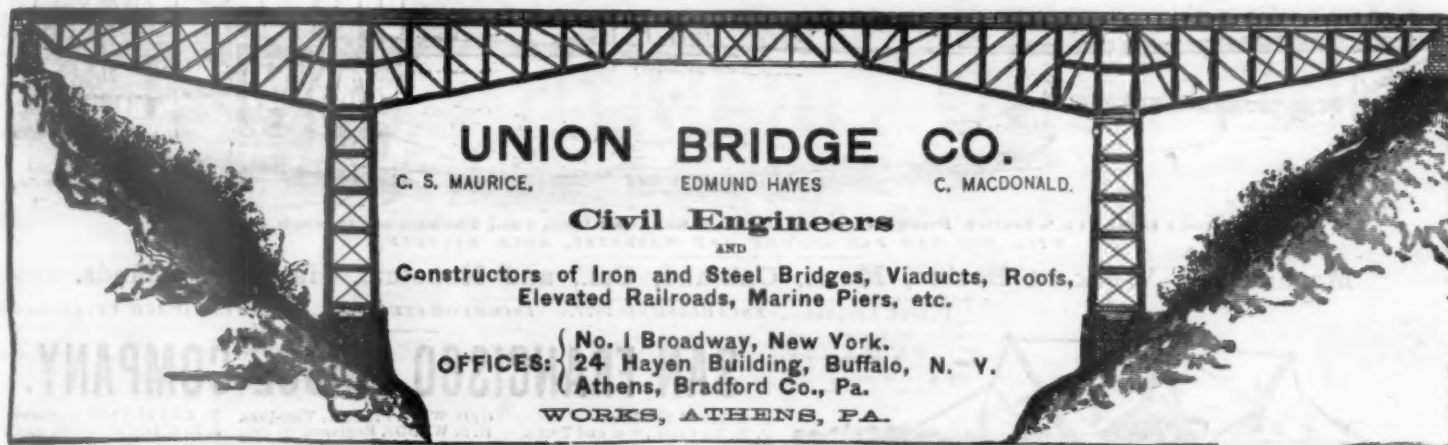


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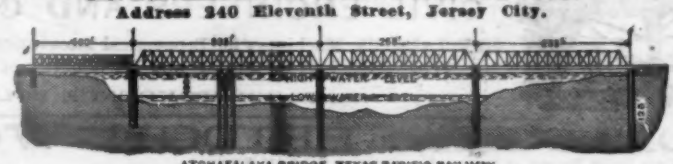


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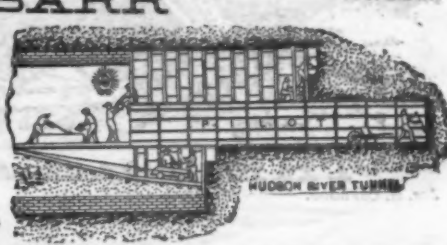
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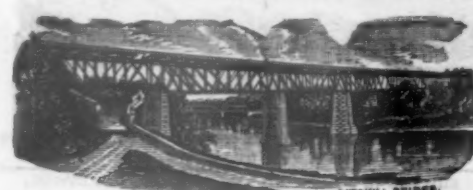
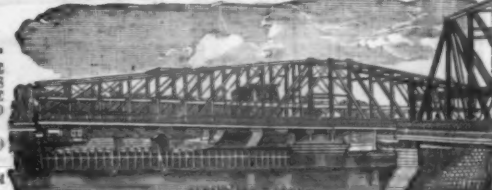
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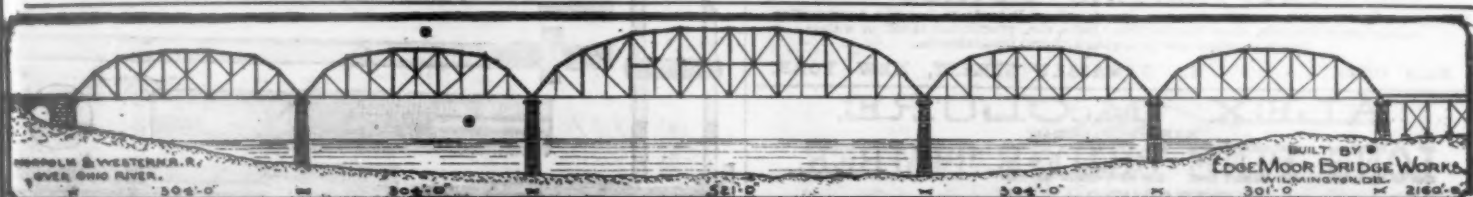



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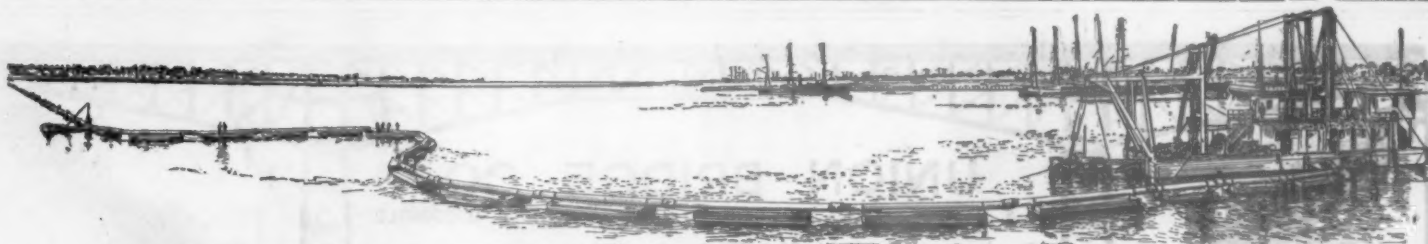


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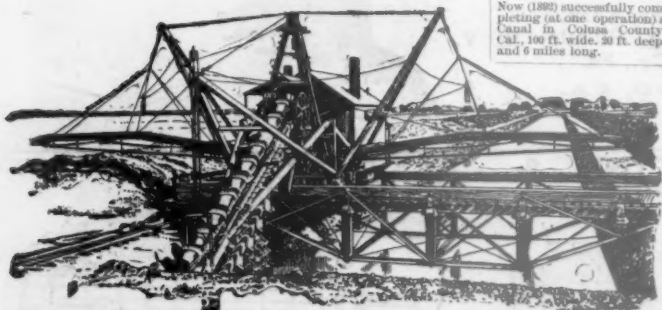
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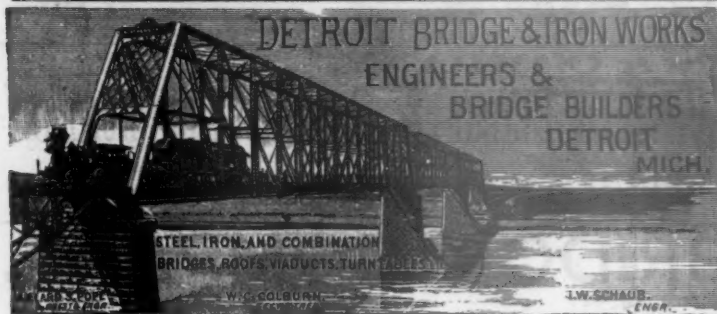
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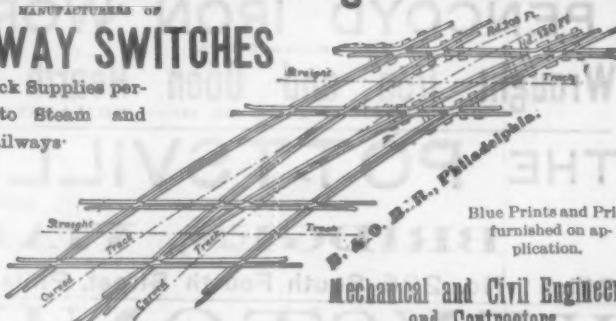
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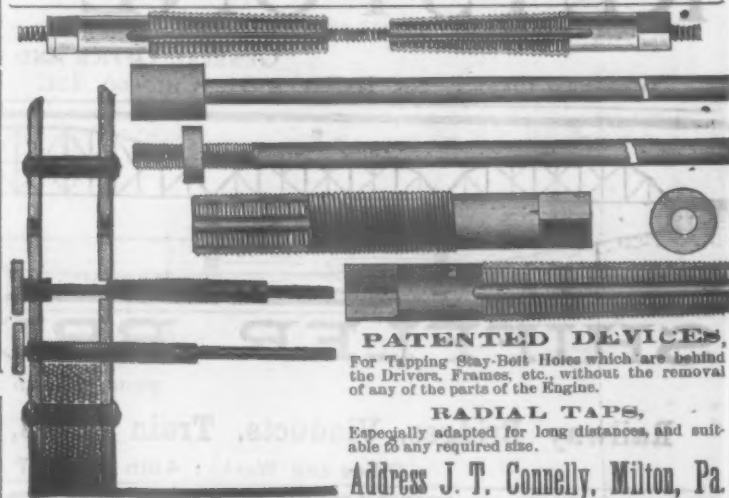
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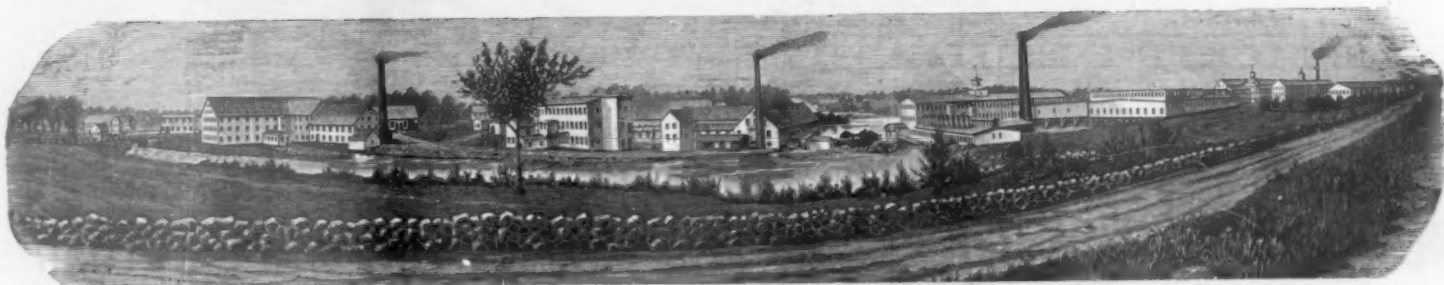
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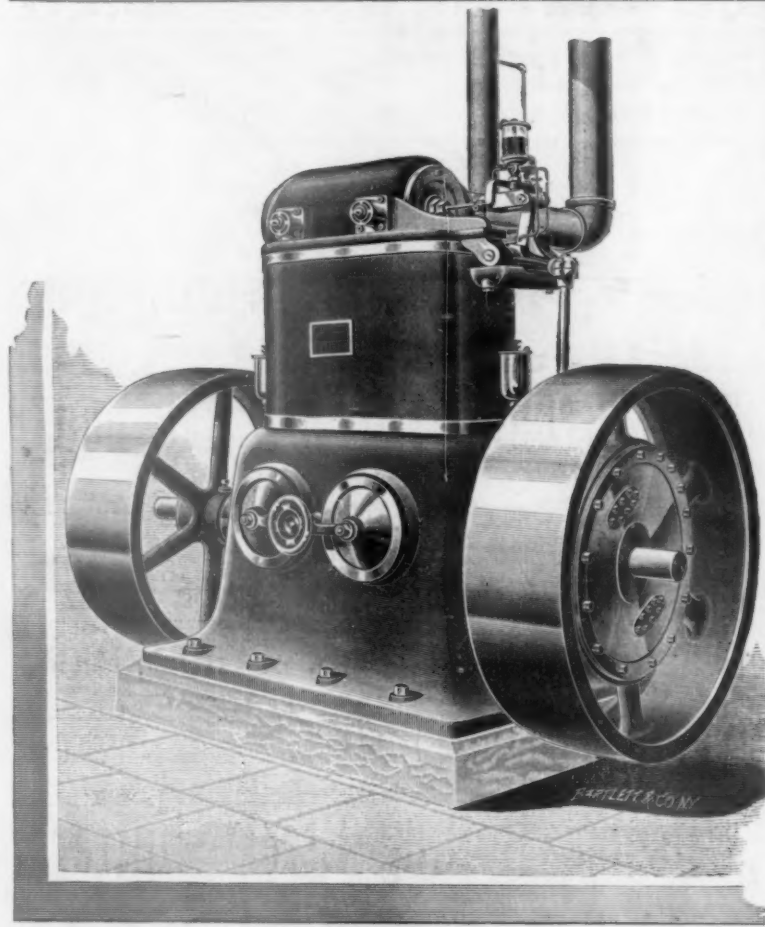
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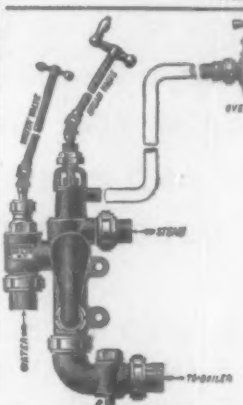
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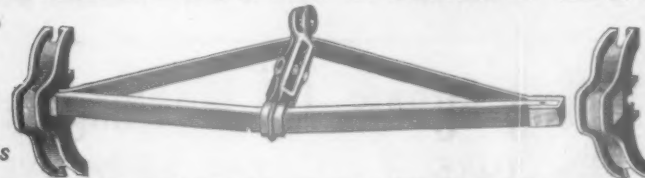
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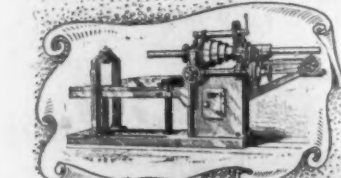
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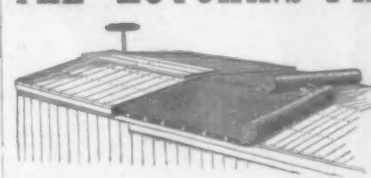
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